The Future Computed

Artificial Intelligence and its role in society

By Microsoft

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Twenty years ago, we both worked at Microsoft, but on opposite sides of the globe. In 1998, one of us was living and working in China as a founding member of the Microsoft Research Asia lab in Beijing. Five thousand miles away, the other was based at the company’s headquarters, just outside of Seattle, leading the international legal and corporate affairs team. While we lived on separate continents and in quite different cultures, we shared a common workplace experience within Microsoft, albeit with differing routines before we arrived at the office.

At that time in the United States, waking to the scent of brewing coffee was a small victory in technology automation. It meant that you had remembered to set the timer on the programmable coffee maker the night before. As you drank that first cup of coffee, you typically watched the morning news on a standard television or turned the pages of the local newspaper to learn what had happened while you slept. For many people a daily diary was your lifeline, reminding you of the coming day’s activities: a morning meeting at the office, dial-in numbers and passcodes for conference calls, the address for your afternoon doctor’s appointment, and a list of to-dos including programming the VCR to record your favorite show. Before you left for the day, you might have placed a few phone calls (and often left messages on answering machines), including to remind sitters when to pick up children or confirm dinner plans.
Twenty years ago, for most people in China, an LED alarm clock was probably the sole digital device in your bedroom. A bound personal calendar helped you track the day’s appointments, addresses, and phone numbers. After sending your kids off to school, you likely caught up on the world’s happenings from a radio broadcast while you ate a quick breakfast of soya milk with Youtiao at your neighborhood restaurant. In 1998, commuters in Beijing buried their noses in newspapers and books – not smartphones and laptops – on the crowded trains and buses traveling to and from the city’s centers.

But today, while many of our fundamental morning routines remain the same, a lot has also changed as technology has altered how we go about them. Today a morning in Beijing is still different from a morning in Seattle, but not as different as it used to be. Consider for a moment that in both places the smartphone charging on your bedside table is the device that not only wakes you, but serves up headlines and updates you on your friends’ social lives. You read all the email that arrived overnight, text your sister to confirm dinner plans, update the calendar invite to your sitter with details for soccer practice, and then check traffic conditions. Today, in 2018, you can order and pay for a double skinny latte or tea from Starbucks and request a ride-share to drive you to work from that same smartphone.

Compared with the world just 20 years ago, we take a lot of things for granted that used to be the stuff of science fiction. Clearly much can change in just two decades.
Twenty years from now, what will your morning look like? At Microsoft, we imagine a world where your personal digital assistant Cortana talks with your calendar while you sleep. She works with your other smart devices at home to rouse you at the end of a sleep cycle when it’s easiest to wake and ensures that you have plenty of time to shower, dress, commute and prepare for your first meeting. As you get ready, Cortana reads the latest news, research reports and social media activity based on your current work, interests and tasks, all of which she gleaned from your calendar, meetings, communications, projects and writings. She updates you on the weather, upcoming meetings, the people you will see, and when you should leave home based on traffic projections.

Acting on the request you made a year before, Cortana also knows that it’s your sister's birthday and she’s ordered flowers (lilies, your sister's favorite) to be delivered later that day. (Cortana also reminds you about this so that you’ll know to say, “you’re welcome” when your sister thanks you.) Cortana has also booked a reservation for a restaurant that you both like at a time that’s convenient for both of your schedules.

In 2038, digital devices will help us do more with one of our most precious commodities: time.
In 20 years, you might take your first meeting from home by slipping on a HoloLens or other device where you’ll meet and interact with your colleagues and clients around a virtual boardroom powered by mixed reality. Your presentation and remarks will be translated automatically into each participant’s native language, which they will hear through an earpiece or phone. A digital assistant like Cortana will then automatically prepare a summary of the meeting with tasks assigned to the participants and reminders placed on their schedules based on the conversation that took place and the decisions the participants made.

In 2038, a driverless vehicle will take you to your first meeting while you finalize a presentation on the car’s digital hub. Cortana will summarize research and data pulled from newly published articles and reports, creating infographics with the new information for you to review and accept. Based on your instructions, she’ll automatically reply to routine emails and reroute those that can be handled by others, which she will request with a due date based on the project timeline. In fact, some of this is already happening today, but two decades from now everyone will take these kinds of capabilities for granted.

Increasingly, we imagine that a smart device will monitor your health vitals. When something is amiss, Cortana will schedule an appointment, and she will also track and schedule routine checkups, vaccines and tests. Your digital assistant will book appointments and reserve time on your
calendar on days that are most convenient. After work a self-driving car will take you home, where you'll join your doctor for a virtual checkup. Your mobile device will take your blood pressure, analyze your blood and oxygen level, and send the results to your doctor, who will analyze the data during your call. Artificial intelligence will help your doctor analyze your results using more than a terabyte of health data, helping her accurately diagnose and prescribe a customized treatment based on your unique physiological traits. Within a few hours, your medication will arrive at your door by drone, which Cortana will remind you to take. Cortana will also monitor your progress and, if you don’t improve, she'll ask your permission to book a follow-up appointment with the doctor.

When it’s time to take a break from the automated world of the future, you won’t call a travel agent or even book online your own flight or hotel as you do today. You’ll simply say, “Hey, Cortana, please plan a two-week holiday.” She’ll propose a custom itinerary based on the season, your budget, availability and interests. You’ll then decide where you want to go and stay.

Looking back, it’s fascinating to see how technology has transformed the way we live and work over the span of 20 years. Digital technology powered by the cloud has made us smarter and helped us optimize our time, be more productive and communicate with one another more effectively. And this is just the beginning.
Before long, many mundane and repetitive tasks will be handled automatically by AI, freeing us to devote our time and energy to more productive and creative endeavors. More broadly, AI will enable humans to harness vast amounts of data and make breakthrough advances in areas like healthcare, agriculture, education and transportation. We’re already seeing how AI-bolstered computing can help doctors reduce medical mistakes, farmers improve yields, teachers customize instruction and researchers unlock solutions to protect our planet.

But as we’ve seen over the past 20 years, as digital advances bring us daily benefits they also raise a host of complex questions and broad concerns about how technology will affect society. We have seen this as the internet has come of age and become an essential part of our work and private lives. The impact ranges from debates around the dinner table about how distracting our smartphones have become to public deliberations about cybersecurity, privacy, and even the role social media plays in terrorism. This has given birth not just to new public policies and regulations, but to new fields of law and to new ethical considerations in the field of computer science. And this seems certain to continue as AI evolves and the world focuses on the role it will play in society. As we look to the future, it’s important that we maintain an open and questioning mind while we seek to take advantage of the opportunities and address the challenges that this new technology creates.
The development of privacy rules over the past two decades provides a good preview of what we might expect to see more broadly in the coming years for issues relating to AI. In 1998, one would have been hard-pressed to find a full-time “privacy lawyer.” This legal discipline was just emerging with the advent of the initial digital privacy laws, perhaps most notably the European Community’s Data Protection Directive, adopted in 1995. But the founding of the International Association of Privacy Professionals, or IAPP, the leading professional organization in the field, was still two years away.

Today, the IAPP has over 20,000 members in 83 countries. Its meetings take place in large convention centers filled with thousands of people. There’s no shortage of topics for IAPP members to discuss, including questions of corporate responsibility and even ethics when it comes to the collection, use, and protection of consumer information. There’s also no lack of work for privacy lawyers now that data protection agencies — the privacy regulators of our age — are operating in over 100 countries. Privacy regulation, a branch of law that barely existed two decades ago, has become one of the defining legal fields of our time.

What will the future bring when it comes to the issues, policies and regulations for artificial intelligence? In computer science, will concerns about the impact of AI mean that the study of ethics will become a requirement for computer programmers and researchers? We believe that’s
a safe bet. Could we see a Hippocratic Oath for coders like we have for doctors? That could make sense. We’ll all need to learn together and with a strong commitment to broad societal responsibility. Ultimately the question is not only what computers can do. It’s what computers should do.

Similarly, will the future give birth to a new legal field called “AI law”? Today AI law feels a lot like privacy law did in 1998. Some existing laws already apply to AI, especially tort and privacy law, and we’re starting to see a few specific new regulations emerge, such as for driverless cars. But AI law doesn’t exist as a distinct field. And we’re not yet walking into conferences and meeting people who introduce themselves as “AI lawyers.” By 2038, it’s safe to assume that the situation will be different. Not only will there be AI lawyers practicing AI law, but these lawyers, and virtually all others, will rely on AI itself to assist them with their practice.

The real question is not whether AI law will emerge, but how it can best come together — and over what timeframe. We don’t have all the answers, but we’re fortunate to work every day with people who are asking the right questions. As they point out, AI technology needs to continue to develop and mature before rules can be crafted to govern it. A consensus then needs to be reached about societal principles and values to govern AI development and use, followed by best practices to live up to them. Then we’re likely to be in a better position for governments to create legal and regulatory rules for everyone to follow.
This will take time — more than a couple of years in all likelihood, but almost certainly less than two decades. Already it’s possible to start defining six ethical principles that should guide the development and use of artificial intelligence. These principles should ensure that AI systems are fair, reliable and safe, private and secure, inclusive, transparent, and accountable. The more we build a detailed understanding of these or similar principles — and the more technology developers and users can share best practices to implement them — the better served the world will be as we begin to contemplate societal rules to govern AI.

Today, there are some people who might say that ethical principles and best practices are all that is needed as we move forward. They suggest that technology innovation doesn’t really need the help of regulators, legislators and lawyers.

While they make some important points, we believe this view is unrealistic and even misguided. AI will be like every technology that has preceded it. It will confer enormous benefits on society. But inevitably, some people will use it to cause harm. Just as the advent of the postal service led criminals to invent mail fraud and the telegraph was followed by wire fraud, the years since 1998 have seen both the adoption of the internet as a tool for progress and the rise of the internet as a new arena for fraud, practiced in increasingly creative and disturbing ways on a global basis.
We must assume that by 2038, we’ll grapple with the issues that arise when criminal enterprises and others use AI in ways that are objectionable and even harmful. And undoubtedly other important questions will need to be addressed regarding societally acceptable uses for AI. It will be impossible to address these issues effectively without a new generation of laws. So, while we can’t afford to stifle AI technology by adopting laws before we understand the issues that lie ahead of us, neither can we make the mistake of doing nothing now and waiting for two decades before getting started. We need to strike a balance.

As we consider principles, policies and laws to govern AI, we must also pay attention to AI’s impact on workers around the globe. What jobs will AI eliminate? What jobs will it create? If there has been one constant over 250 years of technological change, it has been the ongoing impact of technology on jobs — the creation of new jobs, the elimination of existing jobs, and the evolution of job tasks and content. This too is certain to continue with the adoption of AI.

Will AI create more jobs than it will eliminate? Or will it be the other way around? Economic historians have pointed out that each prior industrial revolution created jobs on a net basis. There are many reasons to think this will also be the case with AI, but the truth is that no one has a crystal ball.

It’s difficult to predict detailed employment trends with certainty because the impact of new technology on jobs is often indirect and subject to a wide range of interconnected innovations and events. Consider the automobile. One didn’t need to be a soothsayer to predict that the adoption of cars
would mean fewer jobs producing horse-drawn carriages and new jobs manufacturing automobile tires. But that was just part of the story.¹

The transition to cars initially contributed to an agricultural depression that affected the entire American economy in the 1920s and 1930s. Why? Because as the horse population declined rapidly, so did the fortunes of American farmers. In the preceding decade roughly a quarter of agricultural output had been used to feed horses. But fewer horses meant less demand for hay, so farmers shifted to other crops, flooding the market and depressing agricultural prices more broadly. This agricultural depression impacted local banks in rural areas, and then this rippled across the entire financial system.

Other indirect effects had a positive economic impact as the sale of automobiles led to the expansion of industry sectors that at first glance appear disconnected from cars. One example was a new industry to provide consumer credit. Henry Ford’s invention of the assembly line made cars affordable to a great many families, but cars were still expensive and people needed to borrow money to pay for them. As one historian noted, “installment credit and the automobile were both cause and consequence of each other’s success.”² In short, a new financial services market took flight.

Something similar happened with advertising. As passengers traveled in cars driving 30 miles per hour or more, “a sign
had to be grasped instantly or it wouldn’t be grasped at all.” Among other things, this led to the creation of corporate logos that could be recognized immediately wherever they appeared.

Consider the indirect impact of the automobile on the island of Manhattan alone. The cars driving down Broadway contributed to the creation of new financial jobs on Wall Street and new advertising positions on Madison Avenue. Yet there’s little indication that anyone predicted either of these new job categories when cars first appeared on city streets.

One of the lessons for AI and the future is that we’ll all need to be alert and agile to the impact of this new technology on jobs. While we can predict generally that new jobs will be created and some existing jobs will disappear, none of us should develop such a strong sense of certainty that we lose the ability to adapt to the surprises that probably await us.

But as we brace ourselves for uncertainty, one thing remains clear. New jobs will require new skills. Indeed, many existing jobs will also require new skills. That is what always happens in the face of technological change.

Consider what we’ve seen over the past three decades. Today every organization of more than modest size has one or more employees who support its IT, or information technology. Very few of these jobs existed 30 years ago. But it’s not just IT staff that needed to acquire IT skills. In the early 1980s, people in offices wrote with a pen on paper, and then secretaries used typewriters to turn that prose into something
that was actually legible. By the end of the decade, secretaries learned to use word processing terminals. And then in the 1990s, everyone learned to do their own writing on a PC and the number of secretaries declined. IT training wasn’t just reserved for IT professionals.

In a similar way, we’re already seeing increasing demand for new digital and other technical skills, with critical shortages appearing in some disciplines. This is expanding beyond coding and computer science to data science and other fields that are growing in importance as we enter the world’s Fourth Industrial Revolution. More and more, this isn’t just a question of encouraging people to learn new skills, but of finding new ways to help them acquire the skills they will need. Surveys of parents show that they overwhelmingly want their children to have the opportunity to learn to code. And at Microsoft, when we offer our employees new courses on the latest AI advances, demand is always extremely high.

The biggest challenges involve the creation of ways to help people learn new skills, and then rethinking how the labor market operates to enable employers and employees to move in more agile ways to fill new positions. The good news is that many communities and countries have developed new innovations to address this issue, and there are opportunities to learn from these emerging practices. Some are new approaches to longstanding programs, like Switzerland’s successful youth apprenticeships. Others are more recent innovations spurred by entities such as LinkedIn and its online tools and services and nonprofit ventures like the Markle Foundation’s Skillful initiative in Colorado.
The impact of AI, the cloud and other new technologies won’t stop there. A few decades ago, workers in many countries mostly enjoyed traditional employer-employee relationships and worked in offices or manufacturing facilities. Technology has helped upend this model as more workers engage in alternative work arrangements through remote and part-time work, as contractors or through project-based engagements. And most studies suggest that these trends will continue.

For AI and other technologies to benefit people as broadly as possible, we’ll need to adapt employment laws and labor policies to address these new realities. Many of our current labor laws were adopted in response to the innovations of the early 20th century. Now, a century later, they’re no longer suited to the needs of either workers or employers. For example, employment laws in most countries assume that everyone is either a full-time employee or an independent contractor, making no room for people who work in the new economy for Uber, Lyft or other similar services that are emerging in every field from tech support to caregiving.

Similarly, health insurance and other benefits were designed for full-time employees who remain with a single employer for many years. But they aren’t as effective for individuals who work for multiple companies simultaneously or change jobs more frequently. Our social safety net — including the United States’ Social Security system — is a product of the
first half of the last century. There is an increasingly pressing need to adapt these vital public policies to the world that is changing today.

As we all think about the future, the pace of change can feel more than a little daunting. By looking back to technology in 1998, we can readily appreciate how much change we’ve lived through already. Looking ahead to 2038, we can begin to anticipate the rapid changes that lie ahead — changes that will create opportunities and challenges for communities and countries around the world.

For us, some key conclusions emerge.

First, the companies and countries that will fare best in the AI era will be those that embrace these changes rapidly and effectively. The reason is straightforward: AI will be useful wherever intelligence is useful, helping us to be more productive in nearly every field of human endeavor and leading to economic growth. Put simply, new jobs and economic growth will accrue to those that embrace the technology, not those that resist it.

Second, while we believe that AI will help improve daily life in many ways and help solve big societal problems, we can’t afford to look to this future with uncritical eyes. There will be challenges as well as opportunities. This is why we need to think beyond the technology itself to address the need for strong ethical principles, the evolution of laws, the
importance of training for new skills, and even labor market reforms. This must all come together if we’re going to make the most of this new technology.

Third, we need to address these issues together with a sense of shared responsibility. In part this is because AI technology won’t be created by the tech sector alone. At Microsoft we’re working to “democratize AI” in a manner that’s similar to the way we “democratized the PC.” Just as our work that started in the 1970s enabled organizations across society to create their own custom applications for the PC, the same thing will happen with AI. Our approach to AI is making the fundamental AI building blocks like computer vision, speech, and knowledge recognition available to every individual and organization to build their own AI-based solutions. We believe this is far preferable to having only a few companies control the future of AI. But just as this will spread broadly the opportunity for others to create AI-based systems, it will spread broadly the shared responsibility needed to address AI issues and their implications.

As technology evolves so quickly, those of us who create AI, cloud and other innovations will know more than anyone else how these technologies work. But that doesn’t necessarily mean that we will know how best to address the role they should play in society. This requires that people in government, academia, business, civil society, and other interested stakeholders come together to help shape this future. And increasingly we need to do this not just in a
single community or country, but on a global basis. Each of us has a responsibility to participate — and an important role to play.

All of this leads us to what may be one of the most important conclusions of all. We’re reminded of something that Steve Jobs famously talked about repeatedly: he always sought to work at the intersection of engineering and the liberal arts.

One of us grew up learning computer science and the other started in the liberal arts. Having worked together for many years at Microsoft, it’s clear to both of us that it will be even more important to connect these fields in the future.

At one level, AI will require that even more people specialize in digital skills and data science. But skilling-up for an AI-powered world involves more than science, technology, engineering and math. As computers behave more like humans, the social sciences and humanities will become even more important. Languages, art, history, economics, ethics, philosophy, psychology and human development courses can teach critical, philosophical and ethics-based skills that will be instrumental in the development and management of AI solutions. If AI is to reach its potential in serving humans,
then every engineer will need to learn more about the liberal arts and every liberal arts major will need to learn more about engineering.

We’re all going to need to spend more time talking with, listening to, and learning from each other. As two people from different disciplines who’ve benefited from doing just that, we appreciate firsthand the valuable and even enjoyable opportunities this can create.

We hope that the pages that follow can help as we all get started.

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