

# The AI Landscape

## Pros and cons of the technology

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In mid-January 2020, Nike announced that it hired John Donahoe for the CEO post.<sup>1</sup> He already had a good understanding of the company because of his role on the board of directors for five years. But it's important to note that Donahoe's prior experience was in the tech industry, as CEO at companies like eBay, PayPal, and ServiceNow.

Nike's move was notable—and in keeping with the company's culture of innovation. For the most part, the hiring of Donahoe was a clear sign that traditional companies need to put digital strategies at the forefront. It's table stakes.

His tech chops proved quite useful early on. When the novel coronavirus hit China in early 2020, Donahoe took swift actions to transform Nike to manage through the disruption. Even though he had to shut down Nike's retail outlets, the acceleration of ecommerce capabilities offset much of the decline in sales.<sup>2</sup>

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<sup>1</sup><https://news.nike.com/news/board-member-john-donahoe-will-succeed-mark-parker-as-president-and-ceo-in-2020-parker-to-become-executive-chairman>

<sup>2</sup>[www.wsj.com/articles/nikes-quarterly-sales-pressured-by-coronavirus-closures-in-china-11585084649](https://www.wsj.com/articles/nikes-quarterly-sales-pressured-by-coronavirus-closures-in-china-11585084649)

In an interview with the *Wall Street Journal*, this is how he described his strategy: “I bring a pretty simple mind-set. It is to see things through the eyes of the consumer. When you’re buying something, you aren’t thinking digital or physical. You’re thinking, I want to get what I want, where I want it, how I want it. Increasingly, that’s a blended digital and physical experience. I believe that experience is the future. The winning companies of the future will bring immersive, blended, digital and physical experiences.”<sup>3</sup>

But to create this type of experience for the consumer, there needs to be next-generation technology. And yes, this means making major investments in AI. So it should also be no surprise that it is the world’s top companies like Nike that are making this a strategic priority.

So why is AI so powerful? What is really going on with this technology? Let’s take a look.

## The Burning Platform

On the company’s earnings call in late April, ServiceNow CEO Bill McDermott said: “Around the world, we see that customers who are farthest along in their digital transformation are better equipped to manage this crisis. Companies lagging behind are realizing that they now have a burning platform. Accelerating digital transformation has become a business imperative.”<sup>4</sup>

He noted that the expected spending on digital transformation, which include major applications of AI, would be \$7 trillion for the next three years. It’s really a mind-boggling number. But for the most part, companies really have no choice anymore. They must go digital in a big way.

McDermott’s reference to the “burning platform” goes back to a famous memo from the former CEO of Nokia, Stephen Elop (written in early 2011). It’s about a story of a worker on an oil rig who awoke because of an explosion. His awful choice was to either stay on board or jump 30 feet into ice waters.

For Nokia at the time, the company was facing something similar: There was the disruption of both Apple’s iPhone and Google’s Android. According to Elop: “The first iPhone shipped in 2007, and we still don’t have a product that is close to their experience. Android came on the scene just over two years ago, and this week they took our leadership position in smartphone volumes. Unbelievable.”<sup>5</sup>

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<sup>3</sup>[www.wsj.com/articles/meet-the-new-nike-boss-trading-tech-for-air-jordans-11581166802](http://www.wsj.com/articles/meet-the-new-nike-boss-trading-tech-for-air-jordans-11581166802)

<sup>4</sup>[www.fool.com/earnings/call-transcripts/2020/04/30/service-now-now-q1-2020-earnings-call-transcript.aspx](http://www.fool.com/earnings/call-transcripts/2020/04/30/service-now-now-q1-2020-earnings-call-transcript.aspx)

<sup>5</sup>[www.theguardian.com/technology/blog/2011/feb/09/nokia-burning-platform-memo-elop](http://www.theguardian.com/technology/blog/2011/feb/09/nokia-burning-platform-memo-elop)

While he did implement some major changes, they were nonetheless too late. Apple and Google were able to build global ecosystems, which had incredibly powerful barriers to entry.

Nokia would eventually exit the mobile phone business and transition to becoming a provider of networking equipment. During all this, the company's market value would go from over \$100 billion to about \$20 billion (by the way, in the story of the worker on the rig, he would survive).

But we have seen the Nokia scenario play out many times. There was Netflix's upending of Blockbuster, Amazon.com's takedown of Borders, and Apple's undoing of Kodak. The examples and case studies could go on and on.

So is it any wonder that many executives are, well, very worried? Of course not. In fact, things are likely to accelerate even more. And perhaps one of the biggest catalysts is actually the COVID-19 virus.

“Digital transformation is no longer a buzzword or a long-term strategy,” said Vivek Ravisankar, who is the co-founder and CEO of HackerRank.<sup>6</sup> “It’s about near-term survival. COVID-19 is accelerating transformations that might have otherwise taken decades. COVID-19 resembles a unique societal crisis, unlike anything we’ve experienced in a generation. I recently came across a very interesting article from Boston Consulting Group which says that when crises of this magnitude occur, they lead to attitudinal shifts. These shifts lead to three things: new policies, newer ways of working, and new consumer behaviors. It’s critical for companies to look at the world with this new lens, given this new reality. We are already familiar with the maxim of every company is going to be a software company but this pandemic is going to accelerate that transition by 10x. Just think about it, every bank needs to have the finest mobile app now (fewer in-person interactions), every healthcare provider should have a video calling facility (Epic system just built a new video calling facility with Twilio), and so on. The idea of rethinking your company to be digital-first is going to get more and more critical.”

## The Benefits of AI

AI is an exciting technology—and it is still in the early stages. But of course, it has already led to major breakthroughs and has been a game changer for many companies. For example, if not for AI, Google would not have been able to scale its massive search engine, which allows for super quick and accurate results. The technology has also been critical in providing for monetization, allowing the company to disrupt the traditional ad industry.

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<sup>6</sup>This is from the author's interview with Vivek Ravisankar on April 2, 2020.

But of course, when it comes to AI, it is much more than better approaches to automation. Let's take a look at some of the other key advantages to this technology:

*Insights:* The simple fact is that many data sets are just too large for humans to understand! But with AI, it's possible to use algorithms to find interesting patterns that can identify revenue opportunities or ways to cut costs.

*Improved decision making:* In Marc Benioff's book, *Trailblazer: The Power of Business as the Greatest Platform for Change*, he describes how he uses his company's AI platform, Einstein, for his bi-weekly executive meetings. He writes: "After my executives offer their opinions and predictions about different regions, products, and opportunities, I turn to the virtual Einstein on my phone to see what he thinks."

Kind of awkward? Perhaps at first. But this management approach has been a big help. It has provided a more objective and unemotional voice for the meetings.

*Wide application:* Unlike various other technologies, AI can be used for many categories, whether for the law, HR, marketing, finance, sales, and so on.

*Predictions:* Traditional forecasting techniques are often subpar. They may be too simplistic and not leverage enough data. But of course, AI can make a major difference. The technology can not only better predict sales and churn, but also provide for applications like predictive maintenance (this is where an AI system can detect when a device or machine may break down).

*Productivity:* AI can speed up processes, which means reacting quicker to customers or emerging problems. It also allows for more time for employees to devote to value-add activities. Why waste time on mundane tasks?

"In today's world, speed to answers is critical to any company, not just for customer support but also for improved processes and faster decision making," said Kevin Gidney, who is the co-founder of Seal Software.<sup>7</sup> "The company that isn't using machine learning will be at a significant disadvantage."

Keep in mind that research from the McKinsey Global Institute forecasts that the gap between those companies that adopt AI and those that do not will only continue to widen.<sup>8</sup> The research shows that the adopters may double their cash flows by 2030. As for the nonadopters? The prediction is that there will be a 20% decline.

*Errors:* True, AI is not error-free. But when there is a solid model in place that is based on quality data, the results should be fairly consistent. Besides, the system can work on a 24/7 basis.

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<sup>7</sup>From the author's interview with Kevin Gidney on April 19, 2020.

<sup>8</sup>[www.alteryx.com/sites/default/files/2019-05/Predictive-Analytics-Made-Practical.pdf](http://www.alteryx.com/sites/default/files/2019-05/Predictive-Analytics-Made-Practical.pdf)

*Risky activities:* We can use AI for dangerous activities. This is often the case with physical robots, which can be used in mines, deep water areas, or even in war zones.

Or look at self-driving technologies. Even though there is yet to be truly autonomous cars, the systems have still been key in helping provide more safety, such as with hazard detection capabilities.

*Scale:* Customer service volumes can vary widely. But AI systems, like chatbots, can help with this. These technologies can be configured to handle typical use cases, which means that a company does not have to hire a large number of people in a short period of time.

*Customers:* They are getting more accustomed to using AI, such as with standout apps like Uber, Facebook, and Siri. This means that companies need to get even more serious about their digital transformation efforts.

“Every business must now conform to the simple and unforgiving mantra of ‘get-online or lose your customers’ because that’s where your buyers are likely to be, and that means it’s harder than ever to get close to your customers through traditional sales approaches,” said Geoff Webb, who is the VP of Strategy at PROS.<sup>9</sup> “Instead, businesses must divine the digital tea leaves, looking for intent-to-purchase signals, cross-referencing with market analysis, and filtering through a highly granular understanding of customer preference.”

*Volume:* Every year, there are thousands of medical research papers published, and it’s impossible for anyone to read them all. It’s even challenging to keep up with just the content in a narrow area of medicine. But this is not a problem for AI. Systems like IBM Watson can read huge amounts of medical literature and summarize the key points and insights— saving much time and effort.

*Learning:* So long as the models are effective and there is high quality data, the AI system should be able to get smarter and smarter.

*Social good:* AI can help improve society, as seen in a report from McKinsey & Co., which has 160 use cases.<sup>10</sup> They show how the technology can help with poverty, natural disasters, and improving education. For example, a nonprofit called the Rainforest Connection uses TensorFlow to create AI models to locate illegal logging. This is done by analyzing audio files. Or there is the case where academics were able to develop a neural network to identify, through the use of drones, poachers in Africa

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<sup>9</sup>From the author’s interview with Geoff Webb on March 25, 2020.

<sup>10</sup>[www.mckinsey.com/featured-insights/artificial-intelligence/applying-artificial-intelligence-for-social-good](http://www.mckinsey.com/featured-insights/artificial-intelligence/applying-artificial-intelligence-for-social-good)

## The Drawbacks of AI

It's true that AI is far from perfect. After all, the technology is generally based on using probabilities that are based on large data sets. Even if there are minor issues, the results can be way off.

So then, what are some of the main issues and problems with AI? Here are some to consider:

*Performance:* Good software not only needs solid developers but also testers. This is even more important for AI since this technology can be complex and sensitive to slight changes.

*Data:* This is the fuel for most AI models. The problem then? It's that quality data is hard to find. Besides, even if you have a good data set, you still need to clean it up, which can take a considerable amount of time.

*Black box:* Some AI models are so complex and intricate, such as for deep learning, that it is nearly impossible to understand the rationales for the outcomes. This could make it so that the technology is not usable in certain contexts, such as for medical research, because of regulatory requirements.

*Bias:* You know the old saying of “garbage in, garbage out” (GIGO). It's a cliché. But this does not detract from its wisdom, as the GIGO concept is spot-on with AI. For example, if your data set is narrowly focused, such as on a demographic or a certain geographic area, then the results can easily be inaccurate. In some cases, the results could be damaging, such as when the algorithms are biased. This may mean, for example, that classes of people are denied a loan based on discrimination.

“56% of executives in a PwC survey have said they would find it difficult to articulate the cause if their organization's AI system were to provide inaccurate or biased information,” said Anand Rao, who is the Global AI Lead at PwC.<sup>11</sup> “Meanwhile, the same survey found that 39% of respondents with AI applied at scale were only ‘somewhat’ sure they would know how to stop their system if something went wrong.”

*Job losses:* As AI gets more sophisticated, the technology will start to undertake human-type activities. This could ultimately result in job losses, which could mean social and economic disruption. We've already seen this happen in various manufacturing industries because of the automation of robots. It's true that several studies point out that AI may ultimately lead to more job opportunities. But even if this turns out to be the case, there will still likely be a transition period, as people will need to go through reskilling.

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<sup>11</sup>The author's interview with Anand Rao on March 29, 2020.

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■ **Note** A study from Genesys shows that 52% of U.S. workers believe their jobs have not been affected by AI. But when asked about what the impact will be within five years, the percentage goes down to 29%.<sup>12</sup>

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*Creativity:* AI can provide some interesting insights and there are algorithms that can create interesting content. But the technology is nowhere near replacing a person's ability to come up with great ideas or concepts.

*Judgement and emotion:* Simply put, there are many human qualities that are currently not replaceable with AI.

"In recruitment, for example, AI can help to match candidates with companies based on their resumes, but only a human being can use interpersonal skills to find the best cultural fit for your company," said Allie Kelly, who is the CMO of JazzHR.<sup>13</sup> "Hiring teams will always be essential in forming and developing candidate relationships based on complex emotions and niche skill sets rather than intelligent design."

*Costs:* AI can be expensive, in terms of the consulting, software tools, and hardware/infrastructure. Then there are the costs for hiring talent, such as experienced data scientists. Oh, and then there are the costs of maintaining and managing existing AI systems.

*Security:* The hacking of AI models is becoming a bigger threat. This could mean that a self-driving car could be hijacked or turned into an autonomous weapon. Actually, with the enterprise, there could be intrusions on critical processes, such as those that involve sensitive data sets.

*Diversity:* This is sorely lacking in the AI field. A research study from New York University calls it a "disaster."<sup>14</sup> Consider the following:

- Over 80% of AI professors are male.
- Only 15% of the AI researchers at Facebook are female. It's 10% at Google.
- About 13% of AI CEOs in the US are women.<sup>15</sup>
- About 71% of the applicants for AI jobs in the US are males.<sup>16</sup>

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<sup>12</sup>[www.genesys.com/press?release=122787](http://www.genesys.com/press?release=122787)

<sup>13</sup>From the author's interview with Allie Kelly on April 10, 2020.

<sup>14</sup>[www.theguardian.com/technology/2019/apr/16/artificial-intelligence-lack-diversity-new-york-university-study?linkId=66248341](http://www.theguardian.com/technology/2019/apr/16/artificial-intelligence-lack-diversity-new-york-university-study?linkId=66248341)

With a lack of diversity, there is more risk that the models will have bias or be inaccurate. There will also be challenges in getting better insights from data.

## The Growth of AI

Sundar Pichai, who is the CEO of Alphabet, said this while at the World Economic Forum in Davos, Switzerland: “AI is one of the most profound things we’re working on as humanity. It’s more profound than fire or electricity.”<sup>17</sup>

Granted, it got some blowback. Pichai’s comment did seem to be over the top, even by Silicon Valley standards. Yet a big part of his job is to build cutting-edge AI that spans software and even hardware. So he is definitely someone to take seriously, right?

Absolutely.

When looking at just about any forecast or study about AI, the charts are upward sloping and involve substantial numbers. Take a report from International Data Corporation (IDC). It shows that spending on AI systems is expected to hit a whopping \$97.9 billion by 2023, for a compound annual growth rate of 28.4%.

David Schubmehl, the research director of Cognitive/Artificial Intelligence Systems at IDC, said: “The use of artificial intelligence and machine learning (ML) is occurring in a wide range of solutions and applications from ERP and manufacturing software to content management, collaboration, and user productivity. Artificial intelligence and machine learning are top of mind for most organizations today, and IDC expects that AI will be the disrupting influence changing entire industries over the next decade.”<sup>18</sup>

The report indicated that more than half of the spending came from banking, manufacturing, healthcare, retail, and professional services. But there was emerging growth in government, media, telecommunications, and personal/

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<sup>15</sup>[www.h2o.ai/democratizing-ai/](http://www.h2o.ai/democratizing-ai/)

<sup>16</sup>[www.theguardian.com/technology/2019/apr/16/artificial-intelligence-lack-diversity-new-york-university-study?linkId=66248341](http://www.theguardian.com/technology/2019/apr/16/artificial-intelligence-lack-diversity-new-york-university-study?linkId=66248341)

<sup>17</sup>[www.bloomberg.com/news/articles/2020-01-22/google-ceo-thinks-ai-is-more-profound-than-fire](http://www.bloomberg.com/news/articles/2020-01-22/google-ceo-thinks-ai-is-more-profound-than-fire)

<sup>18</sup>[www.idc.com/getdoc.jsp?containerId=prUS45481219](http://www.idc.com/getdoc.jsp?containerId=prUS45481219)



consumer services. Just some of the common use cases included automated human resources (HR) and pharmaceutical research and development (R&D).

To get a sense of the growth in the AI industry, here are some other interesting studies:

- Accenture predicts that AI will double annual economic growth rates by 2035. The report also states that the technology will “[spawn] a new relationship between man and machine. The impact of AI technologies on business is projected to boost labor productivity by up to 40 percent by fundamentally changing the way work is done and reinforcing the role of people to drive growth in business.”<sup>19</sup>
- Tractica, a technology research firm, forecasts that the AI software market will hit \$126 billion in revenues by 2025.<sup>20</sup> While it’s been mostly consumer tech companies that have thrived, the next phase will be growth in AI-based enterprise software companies.
- The number of peer-reviewed AI research papers shot up over 300% from 1998 to 2018.<sup>21</sup> In fact, China’s output was about at the levels of Europe and exceeded the US. Countries like Singapore, Switzerland, Australia, Israel, the Netherlands, and Luxembourg have also been prolific (on a per-capita basis).

## What Is Driving AI?

The tech world is famous for its buzzwords. They will initially gin up lots of excitement and venture capital investment. But then there will come a reality check—that is, the technology will often fall well short of the expectations. It’s all too common.

But as for AI, the category has remained quite durable. Then again, as you’ve already seen in this chapter, the technology offers clear-cut advantages. Yet there are also some notable catalysts that have helped to fuel the growth.

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<sup>19</sup>[https://newsroom.accenture.com/news/artificial-intelligence-poised-to-double-annual-economic-growth-rate-in-12-developed-economies-and-boost-labor-productivity-by-up-to-40-percent-by-2035-according-to-new-research-by-accenture.htm?\\_ga=2.95939733.882226627.1588554804-1278195360.1586745913](https://newsroom.accenture.com/news/artificial-intelligence-poised-to-double-annual-economic-growth-rate-in-12-developed-economies-and-boost-labor-productivity-by-up-to-40-percent-by-2035-according-to-new-research-by-accenture.htm?_ga=2.95939733.882226627.1588554804-1278195360.1586745913)

<sup>20</sup><https://tractica.omdia.com/newsroom/press-releases/artificial-intelligence-software-market-to-reach-126-0-billion-in-annual-worldwide-revenue-by-2025/>

<sup>21</sup><http://ide.mit.edu/news-blog/news/2019-ai-report-tracks-profound-growth>

Here's a look:

- *Data explosion*: The emergence of mobile platforms, social networks, and cloud computing has resulted in enormous volumes of data. But there is also the Internet of Things (IoT), which uses sensors to collect huge amounts of data. With all this data, it has become much easier to create powerful AI models.
- *Venture capital*: Investors have continued to write checks to fund AI startups. During the first quarter of 2020, VCs invested in 285 startups in the sector in the U.S. for a total of \$6.9 billion. But large tech companies like Google, Facebook, Apple, and Microsoft have also been making their own investments. Some of the rounds have been blockbusters. In July 2019, Microsoft announced a \$1 billion round for OpenAI, which included a partnership with the Azure cloud platform. CEO Satya Nadella had this to say about the deal: “AI is one of the most transformative technologies of our time and has the potential to help solve many of our world’s most pressing challenges.”<sup>22</sup>
- *Deep learning*: During the past decade, there have been major breakthroughs with the theoretical aspects of AI. A key part of this has been the emergence of deep learning. This involves highly sophisticated models that can find patterns in huge amounts of data. The technology has been groundbreaking for applications like image recognition and self-driving vehicles.
- *GPU (graphics processing unit)*: In the early 1990s, Nvidia pioneered this semiconductor. Unlike a typical CPU (central processing unit), a GPU has a large number of cores that can handle thousands of threads simultaneously. At first, this technology was quite useful for high-end gaming platforms. But during the past decade, the GPU has also become a standard for handling the huge processing needs for AI models, especially with deep learning applications.

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<sup>22</sup><https://news.microsoft.com/2019/07/22/openai-forms-exclusive-computing-partnership-with-microsoft-to-build-new-azure-ai-supercomputing-technologies/>

<https://venturebeat.com/2020/04/14/ai-startups-raised-6-9-billion-in-q1-2020-a-record-setting-pace-before-coronavirus/>

- *Open source software*: This is software that is created by a community of developers. The technology is freely available, so long as any enhancement is provided for free. Because of this, open source software has seen significant growth. It's also been critical for the development of AI. There are a myriad tools and platforms like Python, Scikit-learn, Keras, TensorFlow, KNIME, PyTorch, Caffe, and Teano.
- *Mega tech operators*: These companies have not only been major investors in AI but also have been aggressive in hiring talent, such as from the world's top universities. Keep in mind that the mega tech operators are generally the source of much of the academic papers for AI.

## How AI Can Go Off the Rails

AI has the potential for doing great harm to a company. Misuse of data or bad applications of models can damage the brand and loyalty of the customers. There may even be fines from government authorities.

Some of the world's top technology companies have been warning investors about such risks through disclosures to the Securities and Exchange Commission. Here's an example from Microsoft's 10-K annual report: "AI algorithms may be flawed. Datasets may be insufficient or contain biased information. Inappropriate or controversial data practices by Microsoft or others could impair the acceptance of AI solutions. These deficiencies could undermine the decisions, predictions, or analysis AI applications produce, subjecting us to competitive harm, legal liability, and brand or reputational harm. Some AI scenarios present ethical issues. If we enable or offer AI solutions that are controversial because of their impact on human rights, privacy, employment, or other social issues, we may experience brand or reputational harm."<sup>23</sup>

Granted, when it comes to corporate matters, the lawyers tend to be extra cautious. Might as well be prepared for the worse, huh?

This is true. But AI can certainly go off the rails. Interestingly enough, Microsoft has real-world experience with this.

Just look at the situation with its chatbot, Tay. This technology would actually go on to be a poster child of how bad AI can be!

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<sup>23</sup>[www.theverge.com/2019/2/11/18220050/google-microsoft-ai-brand-damage-investors-10-k-filing](http://www.theverge.com/2019/2/11/18220050/google-microsoft-ai-brand-damage-investors-10-k-filing)

The origins of Tay go back to 2014, when Microsoft implemented a chatbot on Tencent's WeChat social network in China. It turned out to be popular, attracting tens of millions of users.

Microsoft then wanted to bring the chatbot to the US. The company renamed it to Tay and put it on Twitter in March 2016.

Unfortunately, it was an absolute disaster. Tay suddenly started to repeat sexist and racist comments, primarily because the underlying technology was partly based on parroting messaging from users! Microsoft took down the app within 24 hours.

The company's corporate vice president of healthcare, Peter Lee, wrote in a blog: "Looking ahead, we face some difficult—and yet exciting—research challenges in AI design. AI systems feed off of both positive and negative interactions with people. In that sense, the challenges are just as much social as they are technical. We will do everything possible to limit technical exploits but also know we cannot fully predict all possible human interactive misuses without learning from mistakes. To do AI right, one needs to iterate with many people and often in public forums. We must enter each one with great caution and ultimately learn and improve, step by step, and to do this without offending people in the process. We will remain steadfast in our efforts to learn from this and other experiences as we work toward contributing to an Internet that represents the best, not the worst, of humanity."<sup>24</sup>

But AI can also have the potential to harm people physically. We got a terrible example of this back in March 2018, when an Uber self-driving vehicle hit a woman pedestrian and killed her.<sup>25</sup> There was a human driver, but the car was in the autonomous mode.

The National Transportation Safety Board investigated the matter for more than a year.<sup>26</sup> The conclusion was that Uber lacked sufficient safety and monitoring measures, as the driver spent a considerable amount of time checking his smartphone. The report also criticized state and federal regulators.

What about the technology? The report also showed that it was not adequately coded to handle pedestrians crossing streets when not in the crosswalks.

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<sup>24</sup><https://blogs.microsoft.com/blog/2016/03/25/learning-tays-introduction/>

<sup>25</sup>[www.theverge.com/2018/3/28/17174636/uber-self-driving-crash-fatal-arizona-update](http://www.theverge.com/2018/3/28/17174636/uber-self-driving-crash-fatal-arizona-update)

<sup>26</sup>[www.theverge.com/2019/11/19/20972584/uber-fault-self-driving-crash-ntsb-probable-cause](http://www.theverge.com/2019/11/19/20972584/uber-fault-self-driving-crash-ntsb-probable-cause)

## Attitudes About AI

Back in 2009, Google's Sergey Brin saw the huge potential for self-driving cars and committed his company to being a major innovator in the category. He recruited Sebastian Thrun, the former director of the Stanford Artificial Intelligence Laboratory, to head up the effort. Consider that he led the team from Stanford that won the 2005 DARPA Grand Challenge for self-driving cars.

Google's investment would eventually turn into a division called Waymo. Yet the progress of the technology has not been swift. Along the way, Google has had to create its own sensors and other hardware. There has also been the need for intensive AI engineering to deal with the nuances of highways. For example, it has been difficult to get enough data. This is why Google has used 10 billion simulated miles for its AI models.

According to Waymo CEO John Krafcik: "Autonomy always will have some constraints. It's really, really hard. You don't know what you don't know until you're actually in there and trying to do things."<sup>27</sup>

But technology is not the only challenge. Waymo has had to deal with skepticism from the public. The fact is that many people simply are not confident with AI, at least for activities like driving. What's more, there are nagging concerns that the technology will result in lost jobs.

In a report in the *New York Times*, Waymo's self-driving cars in Chandler, Arizona, actually became an object of scorn and anger. Some people would throw rocks at the vehicles, point guns at them, slash the tires, and attempt to run them off the road.<sup>28</sup>

This may sound like an outlier but it really is not. As AI becomes more pervasive, there will be growing worries from the public.

Take an extensive survey of about 6,000 adults from Pegasystems, a top software company. When asked about their attitudes towards businesses using AI, the results were mixed. About 35% were comfortable with the technology but 28% were not.

The report concludes: "But some harbor deep-rooted fears about AI, and most still prefer the familiarity of the human touch over a faceless machine when given the option. For others, the AI experience isn't yet living up to their expectations. And across the board, we found most consumers just don't understand AI—not realizing how it already touches their lives every day."<sup>29</sup>

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<sup>27</sup>[www.cnet.com/news/alphabet-google-waymo-ceo-john-krafcik-autonomous-cars-wont-ever-be-able-to-drive-in-all-conditions/](http://www.cnet.com/news/alphabet-google-waymo-ceo-john-krafcik-autonomous-cars-wont-ever-be-able-to-drive-in-all-conditions/)

<sup>28</sup>[www.nytimes.com/2018/12/31/us/waymo-self-driving-cars-arizona-attacks.html](http://www.nytimes.com/2018/12/31/us/waymo-self-driving-cars-arizona-attacks.html)

<sup>29</sup>[www.ciosummits.com/what-consumers-really-think-about-ai.pdf](http://www.ciosummits.com/what-consumers-really-think-about-ai.pdf)

In other words, companies really need to be mindful of the sentiments toward AI. This means there needs to be ongoing education and training. It's also important to provide support, such as with reskilling of the workforce. If not, a company will likely not get the full benefits from AI.

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■ **Note** A study from Oracle and Future Workplace shows that 70% of employees use AI in their everyday personal lives but only 24% use it at their workplace.<sup>30</sup>

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## The Rise of AI-Driven Companies

In the book *Competing in the Age of AI: Strategy and Leadership When Algorithms and Networks Run the World*, Harvard professors Marco Iansiti and Karim R. Lakhani set forth an interesting vision of the future. It's about how there will be the emergence of AI-driven companies, which will redefine the norms of business. The competitive advantages will primarily be data, algorithms, and hyperscale. As the authors note: “[AI] is transforming the very nature of companies—how they operate and how they compete. When a business is driven by AI, software instructions and algorithms make up the critical path in the way the firm delivers value.”

A company's future competitor may not be a traditional rival, either. It could be a startup that raises huge amounts of venture capital or a mega tech firm like Apple, Amazon, or Microsoft. Actually, Amazon has already demonstrated this multiple times, as the company has moved aggressively into categories like healthcare, advertising, package delivery, small business lending, video streaming, and cloud computing. It seems the only way to combat this giant is actually through antitrust laws since the market power is so dominant.

So then what does an AI-driven company really look like? According to Iansiti and Lakhani, the analogy is to think of an AI factory and it has four components:

- *Data pipeline*: There is a system that efficiently processes large amounts of data, such as by cleaning it, making sure there is compliance and detection for bias.
- *Algorithm development*: When approaching a problem, you want to use algorithms on data to find solutions. They essentially help make predictions. Some can be relatively straightforward, such as forecasting churn rates. But then you can get quite advanced, say with building a chatbot to interact with your customers.

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<sup>30</sup>[www.oracle.com/us/products/applications/oracle-ai-at-work-report-5037501.pdf](http://www.oracle.com/us/products/applications/oracle-ai-at-work-report-5037501.pdf)

- *Experimental platform:* You want a system where it is easy to try out different ideas. For example, suppose you want to know the key factors for churn. The experimental platform should be the key.
- *Software infrastructure:* There needs to be a modern technology layer that relies on modular and component-based architectures. This makes it easier to evolve the AI as the technology gets more sophisticated.

All this takes time and investment to build. But it is well worth the effort. And once in place, there needs to be a culture that involves looking at all parts of the business with AI in mind.

To get a case study of this, take a look at Netflix, which was launched in 1997. The company's founders, Marc Randolph and Reed Hastings, had impressive tech backgrounds. But they brought more than just software abilities to Netflix. There was also a focus on using data to make better decisions. They used creative approaches to do this. In 2006, Netflix announced a \$1 million (US) prize to anyone who could create a better algorithm for recommending films. The company open sourced a data set to help with the effort. As a result, the contest stirred up much interest and PR, leading to innovations in analytics. The \$1 million turned out to be negligible compared to the benefits.

Being an AI-driven company, Netflix has become the global leader in streaming video, with a whopping 183 million subscribers.<sup>31</sup> The company's market value of \$200 billion is actually higher than Disney's and Comcast's.

It seems that just about every part of the company's business is based on AI and analytics. For example, Netflix has teams of data scientists who research ways to improve the quality and speed of streaming. In some parts of the world, the Internet infrastructure is simply not robust but sophisticated algorithms can help deal with this, such as with optimal timing of caching.

But AI has also been extremely helpful in creating engaging content. According to Ted Sarandos, the Chief Content Officer at Netflix: "There's no such thing as a 'Netflix show.' That as a mind-set gets people narrowed. Our brand is personalization."<sup>32</sup>

Effective personalization means that Netflix can keep getting subscription fees from its customers, which can then fuel more investment in infrastructure, content, and AI. It's a virtuous cycle that has made the company highly competitive.

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<sup>31</sup>[www.wsj.com/articles/netflix-adds-16-million-new-subscribers-as-home-bound-consumers-stream-away-11587501078](http://www.wsj.com/articles/netflix-adds-16-million-new-subscribers-as-home-bound-consumers-stream-away-11587501078)

<sup>32</sup><https://twitter.com/mip/status/1006084544758534144>

Netflix built its own technology platform for the personalization, called Polynote. It works with other common AI tools like Apache Spark, Scala, and Python. In October 2019, Netflix open sourced the technology.<sup>33</sup>

Then what are the approaches to AI and personalization that Netflix uses? What has worked? Here are just a few:

*AI thumbnails:* Yes, a big part of the success of Netflix is the extensive content library. But this means little if users cannot find the show they want to watch. The irony is that people usually don't even know what they really like!

But AI has been critical in helping to solve this complex problem. Netflix processes huge amounts of data—in near real-time—on what is clicked, what is viewed and for how long, where there is rewinding, the device used, the time of day, and so on. The technology infrastructure has been built to track and measure every user interaction.

This approach to data is in stark contrast to the approach of the traditional Hollywood business model, which relies on demographic information like age and gender. But Netflix does not base its recommendations on this type of information. This kind of data simply does not have much predictive power.

As should be no surprise, the workflow of the Netflix system is quite structured. Here's a look:

- *Jump starting:* After you create an account or add a new profile, Netflix will ask you to choose some of your favorite titles. With this data, the system will begin to create your personalization graph. What if this step is skipped? Netflix will provide a diverse set of popular titles and iterate from this to get a better understanding of the user.
- *Supersede:* When you start watching movies on the service, the AI engine will negate the initial preferences. Also, the more recent titles will have more weight in the algorithms.
- *Ordering:* This matters. That is, the way titles are organized on the screen can help with improving the user experience. For example, a row has three layers of personalization: the choice of the row, which titles appear, and the rankings of how they appear. The strongest recommendations start from the top left and go to the right (unless the service is in Arabic or Hebrew).

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<sup>33</sup><https://venturebeat.com/2019/10/23/netflix-open-sources-polynote-to-simplify-data-science-and-machine-learning-workflows/>



This creates a continuous cycle of improvement. According to the Netflix website: “Our data, algorithms, and computation systems continue to feed into each other to produce fresh recommendations to provide you with a product that brings you joy!”<sup>34</sup>

But the level of the personalization extends even to the artwork and photos of the thumbnails for each of the titles. The AI system will scan through the frames of each of the films and create a custom visual that is engaging. Often this is a picture of a popular actor. The AI models indicate that close-ups are usually better.

Back in 2014, Netflix’s global manager of creative services noted that the thumbnail was the most important influencer on a user’s decision about what show or movie to watch and accounted for more than 82% of the focus when browsing.<sup>35</sup> And timing was crucial. A user spent an average of 1.8 seconds when evaluating a title.

*Test, test, test:* This is a mantra at Netflix. You cannot assume something is true unless you have first tested the hypothesis with data and algorithms. For example, like many other sites, Netflix had user reviews. Sounds like a good thing, right?

Not at all. The data scientists tested them and the models showed that viewership went down because of the negative reviews!

*Microgenres:* Genre is fairly simple for traditional Hollywood films, with categories like Horror, Action, Suspense, Romance, Comedy, and so on. But for Netflix, this was not enough. The company set out to take a data-driven approach to create microgenres that are personalized to unique tastes (there are over 27,000).<sup>36</sup> Some examples include “Cult Comedies Featuring a Strong Female Lead” and “Classic Suspenseful Conspiracy Movies from the 1970s.” By doing this, the AI engine could better match a movie to the user.

But interestingly enough, the creation of this data was not completely automated with an AI model. Netflix hired screenwriters and film fans to help come up with the microgenres. The main reason is that the company realized that AI really could not accurately determine microgenres by analyzing the film.

This is important since data-driven approaches can sometimes be counterproductive. Netflix has learned this the hard way with its experiences in Hollywood. When it uses thumbnails and other personalization techniques, there is sometimes anger from actors who feel they are getting ignored.<sup>37</sup>

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<sup>34</sup><https://help.netflix.com/en/node/100639>

<sup>35</sup><https://becominghuman.ai/how-netflix-uses-ai-and-machine-learning-a087614630fe>

<sup>36</sup>[www.finder.com/netflix/genre-list](http://www.finder.com/netflix/genre-list)

<sup>37</sup>[www.wsj.com/articles/at-netflix-who-wins-when-its-hollywood-vs-the-algorithm-1541826015](http://www.wsj.com/articles/at-netflix-who-wins-when-its-hollywood-vs-the-algorithm-1541826015)

Or, in some cases, they may have projects that are very personal to them but may not necessarily get high viewership. Yet if Netflix wants to have long-term relationships with these actors, then there may be circumstance when it is best to ignore the data. It's a balancing act.

*Search:* This is an area that is crucial for the personalization experience. To get the best results, Netflix employs a variety of AI techniques like natural language processing, traditional machine learning, and text analytics. All this is built for many languages and cultural differences.

*Marketing and messaging:* To keep users coming back, Netflix uses email marketing and notifications. All are personalized based on user behavior. According to the Netflix website: "We deliver billions of messages per year, and we work on the personalization algorithms that decide what to send, when, and to whom. Our algorithm aims to optimize for member joy while being mindful of the volume of messages we send out." This extends to marketing campaigns on platforms like Facebook and Twitter, which are highly programmatic.

*Creative:* Of course, the Hollywood way for coming up with ideas is to rely on creative geniuses like Steven Spielberg and George Lucas. True, AI is nowhere near matching this ability but Netflix is using the technology to help supplement the process. This is vitally important for the company since it spends billions of dollars on original content.

So how does AI help out? Essentially, it makes it so that employees do not have to spend too much of their time on tasks like scheduling, budgeting, finding locations, handling post-production activities (to help with editing, sound, color correction, etc.), and localizing for different countries. The AI models optimize the costs along with the creative vision. To put things into perspective, scheduling a TV show or movie could easily take over 100 hours. Or consider post-production. In the case of the epic movie *Apocalypse Now*, the process took two years.<sup>38</sup>

## The Challenges of AI

By reading stories in the media or hearing pitches for software companies, the perception is that AI is not necessarily difficult. But the reality is something different. When it comes to utilizing your company's data, finding use cases, building models and deploying them, there are many tough challenges. Now it's true that things are getting easier and the tools more powerful. But it will take some time until we get true "out of the box" AI.

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<sup>38</sup><https://netflixtechblog.com/studio-production-data-science-646ee2cc21a1>

Thus, if you are having troubles with your own efforts, do not despair. Many other companies do too—even companies that have strong technical teams and experience with software.

Here's a look at some of the surveys and research on the topic:

- In a survey from Accenture of 1,100 executives across the world, about 45% say they have deployed sustainable AI systems that are creating acceptable benefits.<sup>39</sup>
- Research from Pactera Technologies estimates that 85% of AI projects do not meet planned business benefits.<sup>40</sup> One of the main reasons is the lack of senior management support.
- A survey from IDC shows that, for those organizations that use AI, only about 25% of them have the technology deployed on an enterprise-wide basis.<sup>41</sup> The report also shows that the failure rate for projects is up to 50%. Just some of the reasons for this include issues with recruiting technical talent and unrealistic planning.

## The Democratization of AI

The pace of development of AI tools and systems is staggering. This has allowed for lower costs, better capabilities, and improved ease of use. The bottom line: It's getting easier for just about any company to use AI.

"AI can benefit all companies and help smaller companies punch way above their weight class," said David Linthicum, who is the Chief Cloud Strategy Officer at Deloitte Consulting LLP.<sup>42</sup> "You can now utilize the technology to provide a better strategic advantage."

Udit Gupta, who is the former Head of Product at Zomato and a founder of an Y Combinator AI startup, agrees: "Anyone who says that AI is just for the larger companies is probably unlettered in the field. The technology for setting up AI and ML has been fairly commoditized, so anyone including individual developers, small companies, and late stage companies can deploy AI to their current projects fairly quickly. Tech giants like Amazon, Google, and Apple are all working to provide plug and play solutions for companies to integrate AI into their products."<sup>43</sup>

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<sup>39</sup>[www.accenture.com/\\_acnmedia/pdf-73/accenture-strategy-ai-momentum-mindset-exec-summary-pov.pdf](http://www.accenture.com/_acnmedia/pdf-73/accenture-strategy-ai-momentum-mindset-exec-summary-pov.pdf)

<sup>40</sup>[www.techrepublic.com/article/why-85-of-ai-projects-fail/](http://www.techrepublic.com/article/why-85-of-ai-projects-fail/)

<sup>41</sup>[www.businesswire.com/news/home/20190708005039/en/](http://www.businesswire.com/news/home/20190708005039/en/)

<sup>42</sup>From the author's interview with David Linthicum on March 25, 2020.

<sup>43</sup>From the author's interview with Udit Gupta on April 29, 2020.

Despite all this, there will still need to be a focus on training of the core concepts of AI and data analytics. The fact is that models require much critical thinking and understanding of statistics, probability, and data analysis.

Another interesting trend, in terms of the democratization of AI, is the emergence of the citizen data scientist. Gartner describes it as follows: “[This is a person who] creates or generates models that use advanced diagnostic analytics or predictive and prescriptive capabilities, but whose primary job function is outside the field of statistics and analytics. Citizen data scientists are ‘power users’ who can perform both simple and moderately sophisticated analytical tasks that would previously have required more expertise. Today, citizen data scientists provide a complementary role to expert data scientists. They do not replace the experts, as they do not have the specific, advanced data science expertise to do so. But they certainly bring their OWN expertise and unique skills to the process.”<sup>44</sup>

By having citizen data scientists, you are creating a more data-driven organization and getting more value from AI efforts. But this will also help with the challenges in recruiting, as many large companies have been aggressive in luring trained data scientists. It really is tough to compete in this environment.

But cultivating citizen data scientists in an organization requires a major commitment in terms of ongoing training. This could mean online courses or even college instruction. With the training, these citizen data scientists may ultimately want to become data scientists, which would mean even more career advancement.

## The Hardware Factor

The main focus of this book is on software-based AI. Why so? When it comes to the enterprise, the key way people develop and interact with this technology is through using tools, algorithms, and data. Besides, when it comes to hardware, such as AI chips, they are often for those with specialized backgrounds within an organization, or these technologies may be accessed via the cloud.

Yet this is not to minimize the importance of this part of AI. Hardware systems are crucial for the development and growth of AI. What’s interesting is that many of the top players in this category are companies known for their software prowess like Microsoft, Facebook, Google, Baidu, and Alibaba. These companies realize that they need a holistic approach to investing in next-generation AI.

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<sup>44</sup><https://blogs.gartner.com/carlie-idoine/2018/05/13/citizen-data-scientists-and-why-they-matter/>

As noted earlier in this chapter, GPUs are the most common for data crunching and modelling. By using more cores on the chip, they can greatly speed up the process of running experiments or delivering AI in real time.

Now while GPUs are certainly powerful, there are certainly limitations as well. One of the big issues is with deep learning, which requires constantly changing the weights of the neurons. This can slow down the training process when using a GPU. But there are other issues like energy consumption, the communication between cores, and the challenges with matrices. Oh, and GPUs are not cheap!

Because of all this, some of the world's top AI experts believe that more needs to be done with hardware systems. For example, this was a major topic of discussion when Geoffrey Hinton, Yann LeCun of Facebook, and Yoshua Bengio joined for a press conference at the MILA Institute for AI in late 2019.<sup>45</sup>

Despite this, there are hopeful signs. Here are just some examples of the innovation with AI chips:

- *Tensor Processing Unit (TPU)*: Google announced this chip in the summer of 2016 at its I/O conference, although the company had been using this technology for its AI applications for at least a year before. As the name implies, the TPU is built specifically for Google's TensorFlow deep learning platform and is meant for scale. For example, a chip can process 100 million photos a day.
- *Habana Goya Chip*: Intel acquired Habana for \$2 billion in late 2019 because the company's own AI chip, the Nervana neural network, was not as good in terms of compute power.<sup>46</sup> Another advantage was that the Habana chip had a large customer base. Note that back in 2016 Intel acquired Nervana Systems for about \$350 million. In other words, the AI chip space does move quickly and cutting-edge technologies can quickly fade away.
- *Neuromorphic chips*: These chips are designed similar to human brain cells or neurons. This technique can be quite effective for deep learning and other neural networks. Intel has been experimenting with neuromorphic chips, such as its Pohoiki Beach system, which can simulate up to eight million neurons.

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<sup>45</sup>[www.zdnet.com/article/ai-on-steroids-much-bigger-neural-nets-to-come-with-new-hardware-say-bengio-hinton-lecun/](http://www.zdnet.com/article/ai-on-steroids-much-bigger-neural-nets-to-come-with-new-hardware-say-bengio-hinton-lecun/)

<sup>46</sup><https://siliconangle.com/2020/02/02/intel-dumps-nervana-neural-network-processors-habanas-ai-chips/>

- *Huge chips*: Yes, these are semiconductors with enormous numbers of transistors. One example is from startup Cerebras Systems, whose AI chips have a whopping 1.2 trillion transistors.<sup>47</sup> This not only greatly increases processing rates but is generally more energy efficient. However, there is a nagging problem: the size. It's about as large as an iPad so it may be too big for certain applications.

## Conclusion

The AI field is certainly exciting and dynamic. In this chapter, we have only scratched the surface of the many aspects of the market.

While AI is challenging and requires focus, the process is getting easier. And this trend will only continue. This definitely bodes well for the success of the technology for many companies.

As for the next chapter, we will cover some of the fundamentals of AI.

## Key Takeaways

- The growth in AI is forecasted to be strong for the long haul. A report from IDC predicts that spending will reach \$97.9 billion by 2023, for a compound annual growth rate of 28.4%.
- Digital transformation is becoming a must-have for many companies. A critical part of this is the adoption of AI.
- Some of the benefits of AI include lower costs, more revenue opportunities, better insights through analyzing data, higher productivity, lower error rates, and the scaling of services.
- Some of the drawbacks of AI include challenges with implementation and building models, data quality and access, bias, lack of human-style judgment and creativity, costs, security vulnerabilities, little diversity, and even potential job losses.

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<sup>47</sup><https://venturebeat.com/2019/09/21/the-ai-arms-race-spawns-new-hardware-architectures/>

- The past decade has seen great strides in the development of AI. Some of the drivers include the explosion of data, such as from social networks, cloud computing platforms, and IoT; growth in venture capital investment; breakthroughs in deep learning; the use of GPU chips; the growth in open source AI platforms; and the impact of mega AI operators like Google, Microsoft, and Facebook.
- There is emerging a new type of modern company that is driven by AI, like Netflix. Many of the decisions and systems are based on data analysis. AI companies have the potential for being highly competitive and disruptive.
- AI is still a challenge and takes a major commitment. The fact is that many projects still fail.
- But AI technology is getting more democratized. The power is increasing in terms of the features and the pricing is reasonable.
- While this book is focused on software-based AI, this is not to minimize the importance of hardware. AI chips are essential for the growth of the industry. Note that there has been more innovation in the space, such as with next-generation technologies like neuromorphic chips.