TREND 1
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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The One-Sentence Definition

Artificial intelligence (AI) and machine learning refers to the ability of machines to learn and act intelligently – meaning they can make decisions, carry out tasks, and even predict future outcomes based on what they learn from data.

What Is Artificial Intelligence and Machine Learning?

Speaking in 2016, Stephen Hawking said, "Success in creating AI would be the biggest event in human history." Now, it's no secret that technology trends often create a lot of hype. But in the case of AI, the hype is warranted. Like Hawking, I believe AI will transform our world and how we live in it.

AI and machine learning already plays a bigger role in everyday life than you might imagine. Alexa, Siri, Amazon's product recommendations, Netflix's and Spotify's personalized recommendations, every Google search you make, security checks for fraudulent credit card purchases, dating apps, fitness trackers … all are driven by AI.

AI and machine learning is the foundation on which many other technology trends in this book are built. For instance, without AI, we wouldn't have achieved the amazing advances in the Internet of Things (IoT, Trend 2), virtual reality (Trend 8), chatbots (Trend 11), facial recognition (Trend 12), robotics and automation (Trend 13), or self-driving cars (Trend 14) – to name just a few.

But what exactly is AI and machine learning, and how does it work? In very simple terms, AI involves applying an algorithm (a rule or calculation) to data in order to solve problems, identify patterns, decide what to do next, and maybe even predict future outcomes. Crucial to this process is an ability to learn from data and get better at interpreting data over time. And this is where the machine learning part comes in. Machine learning is a subdiscipline of AI, and it involves creating machines that can learn. ("Machines," by the way, may include computers, smart phones, software, industrial equipment, robots, vehicles, etc.)

The human brain learns from data, not a preprogrammed set of rules. We humans are continually interpreting and learning from the world around us. We generally get better at this process over time, learning from our successes and failures. And we make decisions or take action based on what we've learned. AI – or, more specifically, machine learning – replicates this process, but in machines. So, rather than just giving a machine a set of rules to follow, machines can now "learn" from data. Deep learning is another AI-related term that you might have heard. If machine learning is a subset of AI, deep learning is a subset of machine learning – it's essentially a more cutting-edge form of machine learning, involving more complex layers of data processing. (For the purposes of this chapter, both machine learning and deep learning will be wrapped up in the umbrella term AI.)

Like humans, the more data a machine has to learn from, the smarter it becomes. That explains why AI has made such dramatic advances in the last few years – advances that we might not have thought

possible 10 or even five years ago. Modern AI needs data to function. And we're now creating more data than ever before (see Big Data, Trend 4). This continual expansion in data, along with advances in computing power, is fueling a rapid acceleration of AI capabilities.

AI isn't just infiltrating our everyday lives; it's going to transform our industries and businesses. According to one survey, 73% of senior executives see AI, machine learning, and automation as important areas to maintain or increase investment in.[1] (Governments, too, are prioritizing AI investment. In 2019, the White House launched a National AI Initiative directing government agencies to commit to advancing AI.[2])

As well as transforming entire businesses and industries, AI is also going to transform many human jobs. IBM predicts that more than 120 million workers globally will need to be retrained in the next three years due to AI.[3] AI-enabled automation (see Trend 22) will have a particularly significant impact and may lead to the displacement of many jobs. But rather than subscribe to a vision of a dystopian future where all human jobs are given over to robots, I believe AI will make our working lives better. Yes, jobs will be impacted by automation and AI, and many current human jobs will no longer exist in 10 or 20 years' time. But AI will enhance the work of humans, and new jobs will arise to replace displaced jobs. (Just think how computing and the internet led to the demise of some jobs but created many more new roles.) What's more, as machines become more intelligent and capable of carrying out more human tasks, I believe that our uniquely human capabilities – things like creativity, empathy, and critical thinking – will become all the more precious and valuable in the workplaces of the future.

How Is Artificial Intelligence and Machine Learning Used in Practice?

AI gives machines the ability to carry out a wide range of human-like processes, such as seeing (think facial recognition), writing (think

chatbots), and speaking (think Alexa). And as machines' ability to act intelligently gets better and better, AI will infiltrate even more of our lives.

Because AI underpins so many other technology trends, throughout this book you'll find lots of specific examples of how AI is used across different businesses and industries. Here, I want to briefly whet your appetite and set out just a few of the amazing things AI can already do.

Thanks to AI, Machines Can Beat Humans at Games

Machines battling man is the theme of many a sci-fi movie. In real life, AI research and development has seen intelligent machines beat their human opponents in some significant (but thankfully less harmful) ways.

- In 1997, IBM's **Deep Blue** chess-playing machine beat world champion Garry Kasparov.[4] Many hailed this as the start of machine intelligence catching up to human intelligence, but the reality is perhaps a little less compelling. Deep Blue used brute force computing power to consider every possible chess move, and that's how it beat Kasparov. (Discover how machines learned to get a lot more creative at game-playing in Chapter 17.)
- In 2011, **IBM's Watson** AI system beat two human contestants at the game show *Jeopardy!*.[5] And not just any contestants – two of the most successful contestants the show had ever seen, who had won $5 million between them.
- In 2018, **DeepMind's AlphaStar** AI beat one of the world's most successful professional players of the real-time strategy game StarCraft II, in an impressive 5–0 victory.[6]
- In 2019, Microsoft revealed its **Suphx** AI can now beat top players at the complex Chinese tile game Mahjong. After 5,000 games, the AI was able to compete at 10th dan ranking

(basically, super-expert level) – a feat that only 180 humans have ever been able to manage.[7]

- Also in 2019, we learned that AI can now solve a Rubik's Cube in 1.2 seconds – that's two seconds faster than the current world record holder (and about 20 years faster than the average human).[8] The **DeepCubeA** system was created by researchers at the University of California, Irvine.

AI Is Driving Advances in Healthcare

In August 2019 the UK government announced it would dedicate £250 million to funding AI in the National Health Service.[9] Here are just a few examples of how AI is beginning to transform healthcare.

- A study published in *The Lancet* in 2019 found that AI is as good as human experts when it comes to **diagnosing disease** from medical images.[10] Deep learning is showing enormous promise in diagnosing a range of diseases, including cancer and eye conditions.
- **MIT** researchers have developed an AI model that can predict the development of breast cancer up to five years in advance.[11] Crucially, the system works as well for black and white patients, whereas similar projects in the past have often been based overwhelmingly on white patients.
- **Infervision's** image recognition technology uses AI to look for signs of lung cancer in patient scans. The technology is already in use in healthcare settings across China.[12]

Books, Music, and Food: How AI Is Transforming Some of Our Favorite Pastimes

Content platforms like Netflix and Spotify are built on AI – they use AI to understand what viewers most want to watch or listen to,

make personalized recommendations, and (in Netflix's case) create new content based on what it knows users enjoy. Here are a few other examples of AI infiltrating our hobbies and downtime.

- Chinese search engine **Sogou** has confirmed it's creating an AI that can read novels aloud, simulating the voice of their authors[13] (in a similar way to how deepfakes can create realistic audio and video content of people in the public eye). This could revolutionize audiobooks, particularly for self-published authors who perhaps don't have the means to create their own audiobooks.
- **Sony** has created an AI that can produce drumbeats for songs. Called AI DrumNet, the system was trained using hundreds of songs, and can now produce its own basic drumbeats to match other instruments on a track.[14]
- **MIT** researchers have taught AI how to reverse engineer pizza. After looking at a picture of a pizza, the AI can identify its toppings, and then tell you how to make it.[15] Why do this, you might be wondering? In theory, this technology could be used to analyze any photo of food and produce a suitable recipe. So if you want to recreate an amazing restaurant meal at home, in a few years' time there might be an app for that!

The Future of AI?

In 2019, Microsoft announced it was plowing $1 billion into AI research lab **OpenAI** – which was founded by, among others, Elon Musk.[16] What's behind such a big investment? OpenAI is dedicated to creating something called artificial general intelligence (AGI), widely considered to be the "holy grail" of AI.

While AI can do some incredible things when it comes to "general intelligence," AI lags way behind the human brain. In other words, AI is great at learning to do specific things, but AI systems can't just

apply that knowledge to other tasks in the way humans can. This is the goal of AGI – to create an AI system that's as generally intelligent and flexible as the human brain. It's not been done yet – in fact, we don't know if AGI is even possible – but Microsoft's investment shows it's certainly a serious goal.

Key Challenges

I opened this chapter with a Stephen Hawking quote, "Success in creating AI would be the biggest event in human history." Hawking immediately followed that up with, "Unfortunately, it might also be the last, unless we learn how to avoid the risks."

AI isn't without its challenges and risks. For one thing, there are potentially huge risks for society and human life as we know it (particularly when you consider some countries are racing to develop AI-enabled autonomous weapons). But let's focus on the key challenges that everyday businesses will have to overcome if they're to deploy AI successfully.

Regulation

There will no doubt be regulatory hurdles to negotiate as regulators begin (quite rightly and belatedly) to take a greater interest in the application of AI. Until now, some of the early adopters of AI have played a bit fast and loose with the technology (Facebook, for example, is facing legal action over its use of facial recognition technology for auto-tagging photos, without gaining user consent).[17] That sort of behavior can't continue, and business leaders will have to take an ethical, responsible approach to AI.

Privacy Concerns

Part of using AI ethically means making sure you respect individuals' privacy, gain consent to use their data for AI applications, and make

it clear how you are using their data. Again, this is where some big players have fallen short in the past. Amazon, for example, faced consumer outrage over the news that contractors were listening to people's Alexa requests. Individuals could not be identified by their audio, and Amazon stressed the practice was necessary to help develop Alexa's capabilities, but the fact remains that most users had no idea that anyone would ever hear their private audio. Amazon has since introduced a "no human review" option to its Alexa settings, which allows users to opt out of their audio being manually reviewed.[18]

Lack of Explainability

Remember I said that AI can now solve a Rubik's Cube in just 1.2 seconds? Interestingly, the researchers who built the puzzle-solving AI can't quite tell how the system did it. This is known as the "blackbox problem" – which means, to put it bluntly, we can't always tell how very complex AI systems arrive at their decisions.

This raises some serious questions around accountability and trust. For example, if a doctor alters a patient's treatment plan based on an AI prediction – when he or she has no idea how the system arrived at that prediction – then who is responsible if the AI turns out to be wrong? What's more, under GDPR (the General Data Protection Regulation legislation brought in by the European Union), individuals have the right to obtain an explanation of how automated systems make decisions that affect them.[19] But, with many AIs, we simply *can't* explain how the system makes decisions.

New approaches and tools are currently being developed that help to better understand how AIs make decisions but many of these are still in their infancy.

Data Issues

Put simply, AI is only as good as the data it's trained with. If that data is biased or unreliable, then the results will be biased or unreliable.

For example, facial recognition technology was found to be generally better at identifying white males than women and people of color, because a leading data set used to train facial recognition systems was estimated to be more than 75% male and 80% white – something that programmers were able to correct by adding a more diverse range of faces to the training dataset.[20] This means companies will need to ensure their data is as unbiased, inclusive, and representative as possible if they're to get the best results from AI.

The AI Skills Gap

Finally, one area in which many companies will struggle is finding the right AI talent. There's a shortage of people who can develop these complex AI systems – and what talent there is tends to be scooped up by the Googles and IBMs of this world. AI-as-a-service (AIaaS) could be part of the solution. AIaaS offerings from companies like IBM and Amazon allow companies to make use of AI tools, without having to invest in expensive infrastructure or new hires, which makes AI much more accessible to businesses of all shapes and sizes.

How to Prepare for This Trend

AI is going to revolutionize almost every facet of modern life, including business. Therefore, despite the challenges involved, businesses cannot afford to overlook the potential of AI. So how might you use AI in your business? Broadly speaking, companies are using AI to improve their business in three ways:

- Developing smarter products (see Trends 2 and 3 for great examples of this).
- Delivering smarter services (check out Trends 18 and 23 as examples of AI-driven services).
- Making business process more intelligent (Trends 12, 13, and 17 for just a few examples of AI-enhanced business processes).

Every business should consider whether they can use AI to improve their business in one or, ideally, all of these ways. But you'll need a robust AI strategy in order to get the most out of AI – and a good AI strategy should always be linked to your overarching business strategy. To put it another way, you need to look at what the business is trying to achieve and then see how AI can help you deliver those strategic goals.

Notes

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