

# Data versus lore: the past and the future of Artificial Intelligence

By Mandy Hathaway

*Because of its simplicity, this article is not meant to be the whole of your learning experience, and educational links will be provided throughout so you can learn more.*

Television, movies, books, everywhere you turn these days, the discussion and stories often center around Artificial Intelligence (AI). Because of the media attention and our vast imaginations, understanding what is real and what is science-fiction can be a challenge.

What is AI really like and what is fantasy, at least for now? This short series will explore that and much more. If you've ever wondered what the future of AI is, then this article is for you.

In this part of the series, we're going to explore the direction that AI development has taken and where it might be headed. How far can it go, and will it?

We know how AI works and how it is being used. We have even considered some of the ethical concerns that impact AI advancement. But the question now, the real question of the hour, is how far can we really take AI advancement. After all, while they are undeniably cool it is still a long way from self driving cars and grocery stores with sensors to a sentient super intelligent robot.

## A Brief History of AI

To look forward, it sometimes helps to start by looking backward. So let's look at a brief history of the development of artificial intelligence. First, it is essential to realize that AI is not as new as many people might assume.

The idea of automatons (creatures with physical bodies and will, but without a soul) date back to ancient mythology. The word "robot" wasn't coined until 1921 by Czech writer Karel Capek in his play about biologically based automatons. In 1950, Alan Turing proposed the Turing test and Isaac Asimov proposed the three rules to govern synthetic life forms. By 1951, the first AI program had been developed. It was taught to play checkers. Shortly after, in 1961, General Motors installed the first robotic assembly line.

This means that all AI systems we now encounter are not new; they result from 70 years of research, progress and testing. One of the limiting factors to AI advancement has always been our technological capacity. The organization Open AI estimates that since 2012, the computing power required to run cutting edge AI software has been doubling every 3.4 months.

## Technological limitations

To understand how important this limitation is, consider that the human brain contains an average of 86 billion neurons and more than 100 trillion neural connections. Compare those numbers with the 10 to 1000 neurons in a

neural network. This is even more remarkable when you consider that the human brain, which uses about 20% of our daily caloric intake, draws only enough energy to power a 20-watt light bulb. "For benchmark: a single Nvidia GeForce Titan X GPU runs on 250 watts."

And this isn't all that still separates AI processing capacity from human capacity. The design of our brains, and our neurons, is an incredibly intricate web. Biological neurons, unlike artificial ones, are multi-directional. They connect forward, backward and side to side in a vast network that can constantly redesign itself, respond to stimuli or trauma, improve connectivity and function, and incorporate new information.

## **Ambiguity and Debate**

In 70 years of research and advancement, we have gone from a simple chess-playing algorithm to automated factories, self-driving cars and voice-controlled home appliances. It is undeniably impressive, almost unbelievable, particularly for those who are nearly as old as the technology.

In all of this time, and through all of this progress, two things have never become clear. From the beginning, experts have been divided about both the ultimate potential of AI and the speed at which development could be expected. From a broad range of fields, educated thinkers have taken up both sides of these debates for decades.

Scientists and philosophers like Roger Penrose and Hubert Dreyfus argue that physical limitations will never allow a computer system to think like a human brain and that they will never develop any form of self-awareness or consciousness as we understand it. Others like David Chalmers, Nick Bostrom and Sam Harris argue that super intelligence, if not general intelligence, is inevitable. One of the reasons for disagreement is a disagreement on what these terms and ideas really mean.

## **Types of Intelligence**

To help us understand this confusion a bit, it might help to think about the different types of intelligence. While the idea of multiple types of intelligence is still a source of debate for psychologists, it will still be helpful for the purpose of comparing humans and machines.

Some people are gifted artists, while others have little artistic ability or interest. Some people are gifted at mathematics, or foreign languages, while others have an extraordinary ability to communicate or care for others.

Octopuses are capable of learning how to open jars; this must take some form of intelligence, but we still wouldn't hire an Octopus to do mathematical calculations.

One of the remarkable things about humans is that a normal, healthy human brain has the capacity for all (or most) of these types of intelligence, simultaneously. This is often called General Intelligence. Furthermore, as long as the human brain is healthy, it can continue to learn, add new connections and adapt to both new information and often even to injury. This is called neural plasticity.

This adaptability and the broad range of different types of intelligence that humans employ simultaneously is one of the main things that sets us apart from current AI technology.

AI systems have particular knowledge, rather than general knowledge like a human being. They may be smarter or more talented than humans in that specific area but that superiority is confined only to the areas in which that system is trained. Even if that involves more than one task or type of skill, the system remains constrained by those limitations. Some systems have been trained to keep gathering information and learning on their own. The data they take in is confined to certain types of data that are being processed in very particular ways.

Algorithms don't feel awe when they encounter a new complex piece of information. They don't understand the nuances of how the information would impact a human student in their place or decide that they would like to develop machine vision to better understand the data that is being processed. They simply collect information and catalog and organize that information. Some current AI systems may collect information unsupervised but they are the core based on statistics.

## **Is general intelligence possible?**

As discussed in part one of this series, the term strong AI often used to describe an AI that has become self-aware. This could include systems that do not want to be turned off, have their own self-defined and unique goals, and that are possibly capable of experiencing emotions. This would be an AI that is, for all intents and purposes, alive.

Those scientists, researchers and philosophers (like Sam Harris, Nick Bostrom, Ray Kurzweil and David Chalmers) who believe that self-aware general artificial intelligence is inevitable all have one thing in common. They believe that the human brain is a wholly biological, computational system. These scientists argue once we have created networks with enough processing power and complexity, consciousness will naturally arise.

On the other side of the debate, scientists and researchers who do not believe that such self-aware systems are possible have various reasons for their views. But most of these reasons have some relationship with what is called the Mind-Body Problem. This is the idea that we are more than just a collection of organs, that something not purely physical is going on. These theories generally argue that not all of human thought and consciousness are physical.

These ideas about non-computational thoughts can include spiritual thinkers (those who believe that the self resides in the soul and can continue without the body). These thinkers do not think that consciousness, like a soul, can be created by human beings.

They can also include scientists like Sir Roger Penrose, an English mathematician, mathematical physicist and philosopher of science. He argues that consciousness is actually due to a system of unique quantum mechanical functions taking place within biological neurons and that it cannot be reproduced synthetically.

Philosopher Hubert Dreyfus was another detractor of the idea of artificial general intelligence. He argues for something called "The Common Sense Logic Problem." His work, based on the work of Martin Heidegger, essentially states that most of what we would consider the common sense necessary to live in the world is not a simple calculation. Instead, it is a complex reaction between our mind and the world which cannot be created synthetically.

Whatever the particular argument, these thinkers do not think that AI is likely to develop consciousness or self-awareness, no matter how much time they are given. This is because they do not believe that these things are solely computational functions of the brain. But even if they are right, do we really need our AI to have feelings and question the meaning of life?

## **Super Intelligence**

There is another variation of these ideas, which is different from general intelligence but could hold just as much potential. It is often referred to as super intelligence, and this idea does not require a system that has consciousness, emotional experiences, or self-awareness. Super intelligence is the idea of a system with the capacity for a variety of intelligence areas with super human speed and computational power. At its core, super intelligence is about highly advanced computational power that exceeds human capacity in a wide range of fields.

Some researchers doubt that either of these types, strong AI or super intelligence, is possible. Others feel that one or both are inevitable. But not only is a consensus in direction lacking, even agreement about potential outcomes is not currently possible.

What do we even mean when we talk about the future of AI? We might expect robots that could pass as humans and be our friends or instead, we could be suggesting a computer that can calculate and apply logistics to solve world hunger. If achievable, either of these options has impressive potential to help solve big world problems.

Now, not only is there no agreement about what is possible, but experts' estimates on a timeline to develop such technologies range from nine to 200 years. All that is currently certain about the future of AI development is that its outcome and progress remain unknown and that's ok.

## **Current Trends**

With so much money being pumped into AI's development (one study estimates 98 billion dollars will be invested in 2023) progress of some sort is probably inevitable. What direction and shape that growth takes will remain to be seen. We can't predict outcomes but we can still be proactive in our planning. We can look at what is going on now, the current trends and research, to get an idea of where the progress is heading and how we can best prepare for upcoming changes.

## **Medical Research and Diagnostics**

Medicine is one of the most critical areas where we already see benefits from AI technology. AI is being used in remarkable laboratory research. In February, MIT researchers announced that they had used a trained machine learning system to identify an existing drug compound previously unknown to work as an antibiotic. This strategy would have been nearly impossible for human researchers as the goal was to identify antibiotic compounds that function in ways that are unlike currently known antibiotics.

It took scientists 13 years to decode the human genome; AI decoded the genome of the COVID-19 virus and made it public on January 27, only seven days after the CDC identified it. These sorts of research advancements are only going to continue and increase over time. The computational power of AI in research settings can be

world-changing.

And let's not forget about the diagnostic skills that these systems now have, which is, in some cases, already better than human doctors. As these systems are trained on more and more case histories and medical images over time, AI diagnosticians will allow for better identification of problems and early intervention of things ranging from cancer to mental health issues.

## **Automation and the Internet of Things**

The adoption of smart devices and personal assistants continues to increase. Devices ranging from automated vacuum cleaners, smart TVs and security cameras; up to digital personal assistants which can check the weather, update your calendar, order groceries and schedule an appointment with your doctor.

It isn't just individuals and households that are embracing automation. From fully automated factories and stores to motorized shelf stocking, physical jobs are being given to automated systems. Additionally, things like risk and profit assessment algorithms and automated customer service staff are all becoming standard operating procedures for many companies, big and small.

The ease that these devices offer in our personal and professional lives and the cost savings for companies are helping to fuel a boom in smart devices. Current estimates are that, in 2020, this market of internet connected devices will increase by 21% compared to 2019. With that market growth, we can assume the number of devices for home and industrial use will continue to grow and diversify. As often happens, this will likely mean that home and business automation will become more affordable over the next several years.

This transition is also the one that has the potential to have an immense impact on the economic systems of all developed countries. As many menial and repetitive jobs become eligible for automation, it will likely become necessary for significant systemic shifts to occur in our current economic models.

## **Weapons and Warfare**

Unfortunately, we can't discuss the current trends in AI technology without discussing weapons and war. Someone always weaponizes the new technology. This is not new and it certainly is not unexpected. All of the technology being used for fun or business is also being used for military purposes.

Autonomous drones, not wholly unlike the drones you can buy online, carry out silent surveillance and deliver explosives without any direct risk to the bomber. Self-driving car technologies are built into tanks. Eventually, wealthy countries will be able to avoid sending soldiers to the battlefronts. Facial recognition software can now be loaded onto weapons, which will then seek out that particular target.

While current regulations require that all dropped bombs and remote kills require human oversight, it is not a big jump to the automation of warfare, at least for developed nations.

The technology available to the governments and militaries is doubtless far more extensive and powerful than the public is aware. These technologies will continue to be developed in the US and other powerful nations. Making sure that these technologies are not abused requires oversight and dedication that is not currently in place.

## **Data Collection and Statistical Analysis**

The final trend we will explore in this article is data collection and the value of data. In part one of this series, we learned that data is valuable because it is collected into massive databases. These databases can be bought, sold and shared, and they are used to train AI to develop predictive algorithms for marketing and other systems.

With enough data, often gleaned by companies from social media and other online behavior, companies can improve, and eventually perfect, their marketing strategies. Marketing costs money. What percentage of flyers, email, online advertisements or other mass marketing for your new baby furniture store reaches your target demographic? If you could buy a list of all the women who are pregnant or likely to become pregnant within the next year, live within 20 miles of your retail location, are likely to buy new furniture and make over 40 thousand a year, why wouldn't you?

Companies pay good money for the data you give away for free. Personal data is a multi-billion dollar business where the consumer is the product and only companies profit.

Maybe you are comfortable with this. Some people find the increased personalization of their online experience to be a benefit, but what about when that data is stolen in a data breach, used unfairly or used against you? What happens when your genetic information is purchased by health insurance providers to weed out people with genetic markers that may or may not indicate future health issues? What about when your income, race or gender are used as data points in determining your fitness for a job promotion?

The protection of private data and the proper usage of available data are essential to protecting people from having their rights and privacy violated. Marketing personalization is only likely to increase, along with the value of data. In many cases, the more data a system has to analyze, the more accurate its predictions are likely to be. Some places, like California and the European Union, have already begun to look at solutions to safeguarding privacy and protecting consumers. Similar laws will likely be introduced in the coming years as the world realizes the risk that data collection poses to consumers.

## **Conclusions and AI's Current Path**

While we cannot know what AI technologies will be capable of in the future or how quickly they will progress, we can be aware of what is going on now. No matter how far AI can progress, current technology is already altering the world we know and impacting modern societies. Progress is inevitable but what that progress looks like is not.

In fifty years, we might have supercomputers that unlock nuclear fusion and solve the environmental crisis or perhaps we'll have robotic friends (or even romantic partners). Or maybe, in fifty years, we will still be pushing the boulder up the hill, always confident that we are nearly at the top. Since we simply can't know what we will be facing, the best bet now is to focus on what we do know and make sure that we do it right.