

## **PART I - Research Purpose**

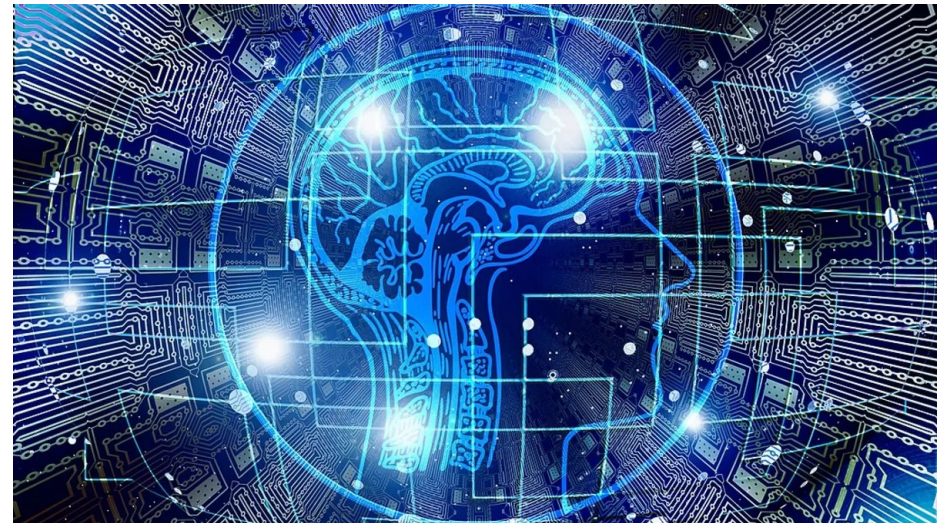
### **Artificial general intelligence: Understanding the future of AI**

What is the current state of artificial general intelligence? What about the future possibilities and potential implications for society and the workforce? Let's take a look.

*Tomilayo Ijarotimi*

**Published:** May 22, 2023 08:47 AM EST

Interviewed by CTA 12 Nov 2023



### ***Artificial-Intelligence***

Artificial Intelligence (AI) has come a long way in the past few decades, and we now live in a world filled with exciting AI technologies.

Specialised algorithms and machine learning techniques have been developed to process vast amounts of data and make predictions based on patterns. We have also seen the emergence of AI chatbots

like ChatGPT, smart home devices, virtual assistants like Siri, Google Assistants, and many more.

But here's the thing: AI is still pretty limited. It can only do what we humans tell it to do, and it's not great at handling tasks it hasn't seen before.

That's where artificial general intelligence (AGI) would come in – it would be like the superstar of the AI world. AGI would be the type of AI that can learn and reason like we humans do, which means it would have the potential to solve complex problems and make decisions independently.

Imagine having an AI system that can actually figure things out independently – now that's something worth getting excited about!

While AGI is still in its early stages of development, it has the potential to revolutionise numerous industries, including healthcare, finance, transportation, and manufacturing. With AGI, medical research could lead to more accurate diagnoses and personalised treatments, while transportation systems could become more efficient and safer, leading to fewer accidents and less road congestion.

In this article, we will delve into the fascinating world of artificial general intelligence. We'll explore its history, its potential impact on society, and the ethical and regulatory implications of its use.



## **What is artificial general intelligence (AGI)?**



Artificial Intelligence

*deepak pal / Wikimedia Commons*

Artificial general intelligence (AGI) is a theoretical form of AI that can learn and reason like humans, potentially solving complex problems and making decisions independently. However, definitions of AGI vary as there is no agreed-upon definition of human intelligence. Experts from different fields define human intelligence from different perspectives.

However, those working on the development of AGI aim to replicate the cognitive abilities of human beings, including perception,

understanding, learning, and reasoning, across a broad range of domains.

Unlike other forms of AI, such as narrow or weak AI, which are designed to perform specific tasks, AGI would perform a wide range of tasks, adapt to new situations, and learn from experience. AGI would reason about the world, form abstract concepts, and generalise knowledge from one domain to another. In essence, AGI would behave like humans without being explicitly programmed to do so.

Here are some of the key characteristics that would make AGI so powerful:

- **Access to vast amounts of background knowledge:** AGI would tap into an extensive pool of knowledge on virtually any topic. This information would allow it to learn, adapt quickly, and make informed decisions.
- **Common sense:** AGI would understand the nuances of everyday situations and respond accordingly. It could reason through scenarios that have not been explicitly programmed and use common sense to guide its actions.
- **Transfer learning:** AGI could transfer knowledge and skills learned from one task to other related tasks.
- **Abstract thinking:** AGI could comprehend and work with abstract ideas, enabling it to tackle complex problems and develop innovative solutions.

- **Understanding of cause and effect:** AGI would be able to anticipate the outcomes of its decisions and take proactive measures to achieve its goals by understanding and using cause-and-effect relationships. This means that it could predict the consequences of its decisions and take proactive measures to achieve its goals.

The main difference between AGI and other forms of AI is the scope of their capabilities. While other forms of AI are designed to perform specific tasks, AGI would have the potential to perform a wide range of tasks, similar to humans.

## The history of AGI

The quest for AGI has been a long and winding road. It began in the mid-1950s when the early pioneers of AI were brimming with optimism about the prospect of machines being able to think like humans. They believed that AGI was possible and would exist within a few decades. However, they soon discovered that the project was much more complicated than they had anticipated.

During the early years of AGI research, there was a palpable sense of excitement. Herbert A. Simon, one of the leading AI researchers of the time, famously predicted in 1965 that machines would be capable of doing any work a human can do within twenty years. This bold claim inspired the creation of the infamous character HAL 9000 in Arthur C. Clarke's sci-fi classic *2001: A Space Odyssey* (and the movie version by Stanley Kubrick).

However, the optimism of the early years was short-lived. By the early 1970s, it had become evident that researchers had underestimated the complexity of the AGI project.

Funding agencies became increasingly skeptical of AGI, and researchers were pressured to produce useful "applied AI" systems. As a result, AI researchers shifted their focus to specific sub-problems where AI could produce verifiable results and commercial applications.

Although AGI research was put on the back burner for several decades, it resurfaced in the late 1990s when Mark Gubrud used the term "artificial general intelligence" to discuss the implications of fully automated military production and operations. Around 2002, Shane Legg and Ben Goertzel reintroduced and popularised the term.

Despite renewed interest in AGI, many AI researchers today claim that intelligence is too complex to be completely replicated in the short term. Consequently, most AI research focuses on narrow AI systems widely used in the technology industry. However, a few computer scientists remain actively engaged in AGI research, and they contribute to a series of AGI conferences.

## The potential impact of AGI

Picture this: a world where machines can solve some of the most complex problems, from climate change to cancer. A world where we no longer have to worry about repetitive, menial tasks because intelligent machines take care of them and many higher-level tasks. This, and more, is the potential impact of AGI.

The benefits and opportunities of AGI are endless. With its ability to process large amounts of data and find patterns, AGI could help us solve problems that have long baffled us. For instance, it could help us develop new drugs and treatments for chronic diseases like cancer. It could also help us better understand the complexities of climate change and find new ways to mitigate its effects.

AGI could also improve human life in countless ways. Automating tedious and dangerous tasks could free up our time and resources to focus on more creative and fulfilling pursuits. It could also revolutionise industries such as transportation and logistics by making them more efficient and safer. In short, AGI can change our lives and work in ways we can't imagine.

However, there are also risks and challenges associated with the development of AGI. One of the biggest concerns is the displacement of jobs, as machines take over tasks previously done by humans. This could lead to economic disruption and social unrest – or a world where the only jobs left were either very high-level or menial jobs requiring physical labor. There are also significant ethical concerns, such as the possibility of machine bias in decision-making and the potential for misuse of AGI by those with malicious intent.

Public figures, including Elon Musk, Steve Wozniak, and Stephen Hawking, have endorsed the view that AI poses an existential risk for humanity. Similarly, AI researchers like Stuart J. Russell, Roman Yampolskiy, and Alexey Turchin support the basic thesis of AI's potential threat to humanity.

Sharon Zhou, the co-founder of a generative AI company, believes that AGI is advancing faster than we can process, and we must consider how we use this powerful technology.

There are also safety risks associated with AGI, particularly if it becomes more advanced than human intelligence. Such machines could potentially be dangerous if they develop goals incompatible with human values. For example, if it's given the task of combating global warming and it decides the best way is to eliminate the cause – humans.

Therefore, it's essential to approach AGI development cautiously and establish proper regulations and safeguards to mitigate these risks.

## **The ethics of AGI**

As artificial general intelligence (AGI) continues to make strides, it's becoming increasingly important to consider the ethical implications of this technology. One of the primary concerns is whether or not AGI can learn and understand human ethics.

One worry is that if AGI is left unchecked, machines may make decisions that conflict with human values, morals, and interests. To avoid such issues, researchers must train the system to prioritise human life, understand and explain moral behaviour, and respect individual rights and privacy.

Another ethical concern with AGI is the potential for bias in decision-making. If the data sets used to train AGI systems are biased, the resulting decisions and actions may also be biased, leading to unfair treatment or discrimination. We are already seeing this with weak AI.

Therefore, ensuring that the data sets used to train AGI are diverse, representative, and free from bias is crucial.

Furthermore, there is the issue of responsibility and accountability. Who will be held accountable if AGI makes a decision that harms humans or the environment? Establishing clear guidelines and regulations for developing and using AGI is crucial to ensure accountability and responsibility.

The issue of job displacement is another concern with AGI. As AI becomes more intelligent, it will take over tasks previously done by humans, leading to job displacement and economic disruption.

Regulation and governance will play a critical role in ensuring responsible AI. Governments and organisations must work together now to establish ethical guidelines and standards for the development and use of AGI. This includes creating mechanisms for accountability and transparency in machine decision-making, ensuring that AGI is developed unbiased and ethically, and establishing safeguards to protect human safety, jobs, and well-being.

## **The future of AGI**

The future of AGI development is a topic of much debate and speculation among experts in the field. While some believe that AGI is inevitable and will arrive sooner rather than later, others are skeptical about the possibility of ever achieving true AGI.

One potential outcome of AGI development is the creation of Artificial Super Intelligence (ASI), which refers to an AI system capable of surpassing human intelligence in all areas. Some experts believe that

once AGI systems learn self-improvement, they can operate at a rate humans cannot control, leading to the eventual development of ASI.

However, there are concerns about the potential implications of ASI for society and the workforce. English physicist and author Stephen Hawking warned of the dangers of developing full artificial intelligence, stating that it could spell the end of the human race, as machines would eventually redesign themselves at an ever-increasing rate, leaving humans unable to compete.

Some experts, like inventor and futurist Ray Kurzweil, believe that computers will achieve human levels of intelligence soon (Kurzweil believes this will be by 2029) and that AI will then continue to improve exponentially, leading to breakthroughs that enable it to operate at levels beyond human comprehension and control.

Recent developments in generative AI have brought us closer to realising the vision of AGI. User-friendly generative AI interfaces like ChatGPT have demonstrated impressive capabilities to understand human text prompts and answer questions on a limitless range of topics, although this is still all based on interpreting data that has been produced by humans. Image generation systems like DALL-E have also upended the visual landscape, generating realistic images just from a scene description, again, based on work by humans.

Despite these developments, AGI's limitations and dangers are already well-known among users. As a result, AGI development will likely continue to be a hotly debated topic, with significant implications for the future of work and society.

## Conclusion

Artificial general intelligence (AGI) can potentially revolutionise the world as we know it. From advancements in medicine to space exploration and beyond, AGI could solve some of humanity's most pressing problems.

However, the development and deployment of AGI must be approached with caution and responsibility. We must ensure that these systems are aligned with human values and interests and do not threaten our safety and well-being.

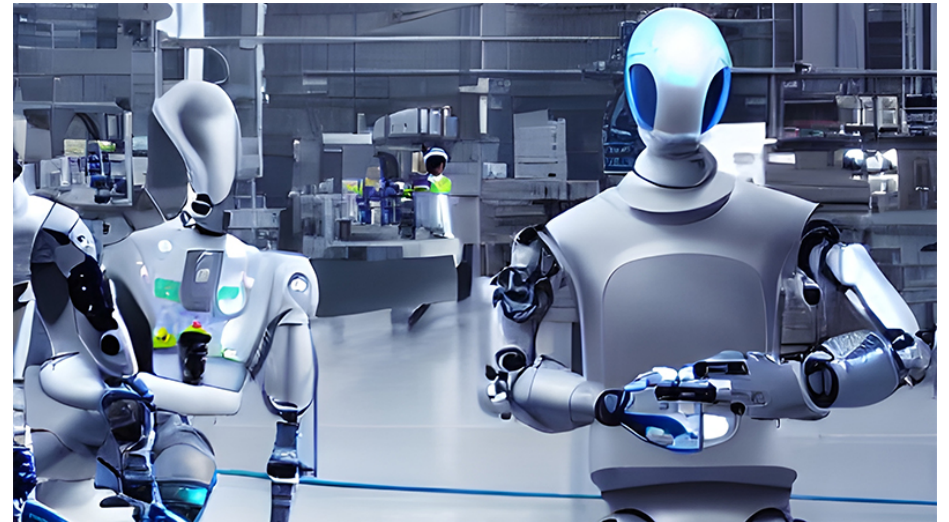
With continued research and collaboration among experts in various fields, we can strive towards a future where AGI benefits society while mitigating potential risks.

The future of AGI is an exciting and rapidly evolving field, and it is up to us to shape it in a way that serves humanity's best interests.

## How AI is already changing engineering – and the role of the engineer

18 Apr 2023

Joseph Flaig



'Human engineers working with robot colleagues in a futuristic factory', as envisioned by the DeepAI text-to-image generator

Alan King has dreamed of conversations with artificial intelligence (AI) for decades. "Since I was 14 and first heard *The Hitchhiker's Guide to the Galaxy*, I've been waiting for this moment with real robots that you can really talk to," he says. Now, they are here – "pretty cool", says the IMechE's head of global membership strategy, with a touch of understatement.

By this point, nearly everyone is familiar with the AI tools that started trickling out late last year, and seem to gain new capabilities each week. ChatGPT, which launched on 30 November, is the best known. "I don't even think the most hardened tech journalists were quite expecting something as profoundly different as ChatGPT," says King. "It

really is like stepping five or 10 years into the future almost overnight, and its capability – without being too hyperbolic – will drive an absolute explosion in terms of what we're going to see.”

Applications of such chatbots, based on large language models (LLM), can seem practically unlimited. From the relatively mundane – writing shopping lists and travel itineraries – to the more radical – formulating entire business plans and executing them, writing scripts in the style of specific authors, even instructing other AIs on complex tasks – ChatGPT and equivalents such as Microsoft's Bing and Google's Bard are revolutionising the production of text, and other types of content.

Chatbots can produce software code, for example, while text-to-image and text-to-video programs are capable of producing photorealistic images of imagined situations. 'Balenciaga Pope', published online last month, showed how unprepared society is for the approaching tsunami of AI-generated social media content.

In short, we seem to be standing on a precipice. Before us lies a very different future to the one that might have been forecast less than a year ago, and countless ways of life and industries will be forced to adapt. From data entry to creative artistic expression, it seems that most activities will be threatened, streamlined, or otherwise changed in one way or another.

Engineering is no different. For many years, the industry has been one of the foremost developers and adaptors of AI-related technology, from machine vision systems to generative design. Now, however, it is one of many sectors facing disruption and transformation from chatbots and their next-generation descendants.



'A futuristic robot factory', generated by DeepAI

'It sounds like me'

Since his teenage years in the '80s, King has always wanted to work at the cutting edge. Describing himself as a technologist, he started work at the IMechE 17 years ago, first as a regional manager, then in business development. Now, he is pivoting towards AI, and is already using the available tools to accelerate his work and explore the boundaries of their capabilities.

He used ChatGPT to write a presentation, for example, the chatbot providing the initial 50-60% of work that he then improved on and added to. King then fed that document into an AI Google Slides extension, which generated a computer presentation within 30 seconds.

The next step was even more radical – King uploaded a 10-minute recording of his voice into the online Synthesia tool, which analysed his



speech and ‘cloned’ it, letting him input text for it to read out in his own voice ([click here to hear a comparison of his real voice and the AI clone](#)). That AI-generated voice introduced the presentation, while a virtual, AI-generated female avatar with a different artificial voice read out the end of the presentation, which King refined with ChatGPT to make it more conversational.

“This version of AI at the moment, let’s call it generation one. It’s a co-pilot, and it’s going to help us do things better, faster, quicker,” he says. “We become the editors of the content, and refine and build on what the AI provides us with.”

King even used ChatGPT to write a bedtime story for his son, including different characters, before using Synthesia to read it out in his voice. The software gave each character different intonation, just like a human narrator might do. “It’s very, very clever,” King says. “But it still sounds like me.”

‘Plausible sounding nonsense’

The power of these first-generation tools is clear, and they can already be very useful for individual engineers. The most obvious application for many will be asking chatbots to write memos, emails or pitches, a process that will be streamlined further as companies such as Microsoft and Google integrate AI tools into their suites of programs.

Others might be tempted to use chatbots for calculations or to provide research data, but anyone doing so should exercise extreme caution. Although LLMs are trained on vast libraries of text from websites, books and scientific journals, the way in which they formulate answers means they can provide “plausible sounding but incorrect or nonsensical answers,” [according to ChatGPT creators OpenAI](#) – shaky foundations for any project.

This partly stems from the fact that answers are probabilistic, rather than deterministic. Roughly speaking, the program selects the most likely word to follow the previous word, not necessarily the most correct or truthful. The mistakes that can happen as a result – [saying the peregrine falcon is the fastest marine mammal, for example](#) – mean most tools are not yet suited for creative engineering work.

They could be well-suited for analysis, however, according to King. “If you’re inputting a set of information to it, and saying ‘I want you to review this, against these criteria,’ as an engineer that could be really powerful,” he says. “It can create faster design cycles, increased automation, it can potentially improve accuracy if done in a controlled way.”

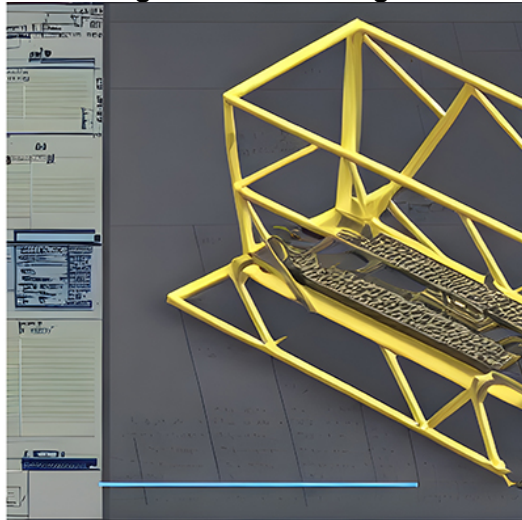
Text-to-design

From giddy excitement to existential terror, the rapid rise of new AI tools provoked a wide range of reactions – but regardless of how people feel about it, the cat is out of the bag. The uncoordinated and unregulated release of new tools with ever greater capabilities has kickstarted an AI arms race, and every organisation has to assess their future relationship with it. “If they don’t, they’ll get left behind by the organisations that do,” says King.

One of the most attractive potential applications for engineering companies could be ‘text-to-design’, a variation on text-to-image programs that generate pictures based on prompts. Could engineers use similar tools to generate engine designs, for example, meeting a set of criteria defined in the prompt?

“I don’t think it’s that far away,” says King, although some barriers will need to be overcome first. Generative design already provides feasible options for components, but it is not used for entire devices. The

'plausible sounding but nonsensical' output issue would also likely plague attempts at building new text-to-design tools.



How an 'engineering design' is imagined by DeepAI. Current text-to-image programs are not suitable for engineering work

Even if probabilistic AI tools provide sensible-looking outputs, they do not understand the 'why' of why something works. Can a program that does not understand why a design might work or not work be trusted to consider the potential harm of an issue down the line?

Engineering companies will also be understandably hesitant about uploading the necessary internal data for specific models to work with and extrapolate from.

If firms could train models on their own securely stored data, they might start to see some huge benefits. The Foundry, by OpenAI, could reportedly enable that. Big engineering firms could rent 'space' on the platform and ask it to build a model specifically for engineering, safe in

the knowledge that all the initial data is accurate, or at least based on their own work.

"Then you get into the realms of real, hugely powerful possibilities," says King. "You could start to create models, designs, drawings – whatever. And it could be instantly rendered into video as well."

#### Big data

IMechE member Ali Parandeh is busy turning some of those possibilities into reality. "Construction, manufacturing and various other engineering sectors like automotive, these are sectors that are really primed for using AI," he says. "They have all the datasets, and they have all the money to put into it, but they just don't have the capability or don't know where to start."

Parandeh hopes to provide a couple of different starting points. Along similar lines to the Foundry, he is working on an idea that would allow companies to train models in their own servers without having to share data with other people, optimising the benefits of the large in-house datasets, other specialist knowledge and intellectual property (IP).

He was unable to go into specifics due to commercial sensitivities, but he stressed that "there is still a long way to go" before AI models are used for safety-critical applications in engineering. Areas with a bit more margin for error – such as demand forecasting or quality assurance – are much better suited, he said.

#### 'A giant robot creates an aeroplane', as imagined by DeepAI

With a background in mechanical engineering, Parandeh started shifting towards AI while working at Atkins. He started his own meet-up group, with sponsorship from Microsoft, offering a beginner's guide to machine learning. He recently received funding from InnovateUK

for Build Your AI, an online educational platform designed to make learning practical skills “as quick and easy as possible”.

Covering everything from the back end to the front end, and all the necessary data layers in-between, the programme has two parts. One is focused on business, teaching non-developers the commercial side of AI to maximise its benefit and the contribution to new IP. The other side is focused on individuals and consumers, teaching practical application of AI at the user’s own pace.

“A lot of people want to do their own mini-projects in the engineering side, and they have ideas that they want to implement but they don’t know where to start,” says Parandeh. He hopes that Build Your AI will tackle that with its structured learning, teaching the ‘full stack’ of required knowledge to enable engineers to build usable applications.

One of AI’s biggest effects will inevitably be on the job market. Automation has been linked with job losses since before the First Industrial Revolution, but the rise of AI tools poses perhaps the biggest ever threat. Companies planning to adopt AI must think very carefully about the impact it will have on their human workforce.

“I think they’re all very real concerns, and people would probably be right to be asking those questions. I would be – and I am,” says King.

“I think about my own son. I think ‘What job is he going to be doing in 20 years from now?’ At the moment, that’s maybe a little bit unclear to me, because I’m not completely sure how this all plays out.”

This is not the first seismic shift in the world of work and communication, however. The last 50 years or so have seen plenty – from desktop computers to the web, the rise of email and Google, then the iPhone, and the explosion of social media that followed.

“This might be the biggest one,” says King, about AI. “But I think it’s OK. I think what happens is we change and we adapt, and roles change,

and what we do changes. And where jobs perhaps do change, new ones are created as well, and new opportunities and For engineers, that could mean a shift towards more editor-like roles in future. First, King suggests, the engineer will have a vision of what they want, and what the product should do. They tell the AI, look at the results when they are available, then tweak the prompts (a process already known as ‘prompt engineering’) until the output is perfect. Such a system with text-to-design applications are not far off, says Parandeh. “You ask it to produce you an engineering design of an engine, and then it gives you that engine design. It’s not going to be perfect, it’s going to have flaws. And then as an engineer who’s chartered, you would then go in and spend the next five hours perfecting that design, instead of having to start from scratch.”

Ageing populations in Europe and elsewhere will mean that engineering workforces will need that assistance, Parandeh adds. “The workforce is declining,” he says. “In 50 years’ time there’s going to be critical workforce shortage, and I think AI is the answer to it because it can actually increase productivity quite significantly, by automating optimising and forecasting capabilities.”

Unlike previous technological revolutions, King predicts the rise of AI could be much swifter and more transformative because developers can use AI tools to improve and develop new programs, creating a kind of feedback loop and driving exponential growth.

“This is an inflection point,” he says. “Until now... it’s been a sort of steady incline. It’s about to go almost vertical, because this technology itself will speed up innovation, and it becomes like a virtuous circle then, you have this human intellect working with machine intellect, and together the ability to think faster and achieve things quicker exponentially – we may be about to enter a period of rapid change

## THE FUTURE OF AI: AGI, ASI, ANI & OUR JOURNEY TO GPT-5 AGI IN THE QUEST FOR TRUE ARTIFICIAL INTELLIGENCE

| Oct 2, 2023

Advancements in the Artificial Intelligence space are happening so fast in 2023 that it's hard to keep up, even for a technology company! In the fascinating landscape of technological evolution, the future of AI and AGI (Artificial General Intelligence) is one of the most exciting prospects.

In this comprehensive guide, we'll explore AGI, ASI (Artificial Super Intelligence), ANI (Artificial Narrow Intelligence), the prospects of human augmentation, and how far away are we from a truly self-sufficient Artificial General Intelligence.

We'll delve into intriguing questions such as "What is true AI?" and "What does the future of AI hold", while exploring the progressive steps from GPT-4 to GPT-5 AGI, and challenging debates like AGI vs AI. Could we witness ChatGPT AGI in the near future? Is AGI possible right now? We'll also examine the concept of ASI or Artificial Super Intelligence, further fuelling the quest for true AI.

So, let's jump in and navigate the exciting realm of AI, its future potential, and the unprecedented changes that lie ahead.



Exploring the future of AI, true Artificial Intelligence and AGI. Image by Markus Winkler via unsplash

### WHAT IS AI (ARTIFICIAL INTELLIGENCE)?

We'll start with the most fundamental question, "What is AI?"

AI is a broad term that can be used to describe a set of automated tasks that can be carried out by computer software. These tasks are *created* and *designed* by humans, and then completed by the software that has also been coded and designed by humans.

With popular tools such as **ChatGPT**, we are beginning to see the very start of systems that can adapt and 'learn' in order to increase

efficiency and accuracy. This is sometimes referred to as **Machine Learning**.

However, even though we use the word 'learn' here, it should be thought of as a different type of learning than what a human is capable of. Learning within this context entails a set of software systems analysing patterns in datasets, and performing changes based on the system's findings.

There are multiple terms that can be used to describe most of what we have in use today (such as **weak AI** or **ANI**). This is what **voice assistants** fall under in terms of AI categorisation.

## **WHAT IS ANI (ARTIFICIAL NARROW INTELLIGENCE)?**

Essentially, Artificial Narrow Intelligence (ANI), or weak AI, refers to the majority of "AI" systems we use today.

This form of AI operates under a limited set of constraints, excelling in single tasks within a pre-defined, narrow area, such as voice recognition, recommendation systems, image recognition, or driving a car. ANI works according to specifically programmed algorithms or learned behaviour from data, but it does not possess consciousness, real understanding, or any kind of autonomous decision-making capability.

ANI systems are capable of "learning" to improve their performance over time, but only within the specific task they've been trained on. For example, a **chess-playing AI** can become increasingly proficient at the

game but can't leverage that knowledge to play a different game like poker.

Despite its limitations, ANI is currently the most widely deployed type of AI, making significant impacts in various industries, including healthcare, finance, and automotive.

Examples include personal voice assistants like Siri or Alexa, spam filters in your email system, customer support chatbots, self-driving cars, and of course ChatGPT, which we will come on to shortly.

## **WHAT IS AGI (ARTIFICIAL GENERAL INTELLIGENCE)?**

Artificial General Intelligence, also known as strong AI, is something that you will likely start to hear about more in the coming months and years.

AGI is the 'holy grail' of artificial intelligence and is considered by most to be 'true AI', as this is more in line with what sci-fi movies and novels envision complex AI to become. In fact, it's a very popular misconception that the AI systems we have in use today are actually AGI.

However, unlike ANI, which is designed and excels at a specific task, AGI systems will be able to learn, think and adapt, and implement knowledge across a broad range of tasks at the same level as a human. They will be able to process incredible amounts of data instantly and display a kind of cognitive flexibility that is the hallmark of human intelligence. There is no doubt that there will eventually be ethical questions raised in regards to AGI machines in the future, and what rights (if any) they should have.

For example, if AGI machines and systems are able to process information in the same way humans can, does that give these systems the ability to reason and feel emotion? It's an interesting question to think about in addition to considering the intellectual capability and raw processing potential of such systems.

## WHAT ABOUT OPENAI AND CHATGPT?

Before we continue, it's important to keep in mind the different types of AI discussed above. It's easy to get mixed up when thinking about the definitions and actual capabilities of **AI** and **AGI**. The rise of ChatGPT is no exception when it comes to this.

## IS CHATGPT AGI?

The quick answer is, no.

The popular and remarkable ChatGPT tool has spurred renewed interest in AI and caused a kind of "AI race" between players such as **OpenAI with its ChatGPT** and **Google with Bard**. We even have other players in the race such as **Meta's open source LLaMA model**.

So, why do people believe ChatGPT is AGI rather than AI (or ANI to be precise)? Well, AGI is described as a form of AI that can learn, plan, solve problems, and come up with creative solutions. This is all true and it's also true that tools like ChatGPT can accomplish similar tasks. The key difference is that AGI will be able to carry out multiple varied tasks *without human intervention*. It will be able to act autonomously and perform intellectual tasks that currently only humans can do.

Despite not being AGI, the importance of ChatGPT and its role in AI should not be underplayed. For all of the reasons mentioned above, we recently produced the below article explaining why we believe ChatGPT is an AI inflection point and likely to bring about change that surpasses that of even the internet.

## IS GPT-4 AGI?

Again, the short answer is, no.

Although **GPT-4** is incredibly impressive, especially with **web browsing capabilities and plugins** that can perform interesting tasks, it still falls under the definition of ANI and not AGI.

Microsoft's researchers have recently claimed that such systems are showing 'sparks of AGI', but **many believe** we are still quite a way away from having an AI system that meets the definition of Artificial General Intelligence.

Although GPT-4 has the ability to identify patterns and provide answers with a human-like persona, it is effectively grabbing and piecing together existing content and information on the internet rather than constructing it itself via reasoning and understanding.

That is one of the key differentiators between AI and AGI — the way the information is created and served to the user.

GPT-4 still operates within strictly human-defined parameters.

## WHAT IS TRUE AI? THE KEY DIFFERENCES BETWEEN AI AND AGI

Let’s continue to break down these AI definitions and see what sets conventional artificial intelligence apart from AGI (or true AI).

With such a complex subject matter, we thought it would be useful to have a side-by-side view of the key differences between AI and AGI to help differentiate the two visually.



What are the key differences	AI (Artificial Intelligence)	AGI (Artificial General Intelligence)
Execution of tasks	General AI is great at performing single-purpose tasks. Can	AGI is similar to how we think of human intelligence. It is capable of
Examples of each	Current examples of AI include Google Bard,	No current AGI systems currently exist. They are

<b>Versatility</b>	AI typically has a very specific task to accomplish	Fully adaptable and can learn to improve or
<b>AI learning</b>	General AI uses Machine Learning and training	Can learn and improve becoming more capable
<b>Human input requirements</b>	AI operates within human-defined constraints, requires	AGI can make choices and decisions without the need for
<b>Creativity</b>	Can output based on human-defined rules, can identify	Capable of human-like creativity and unique ideas. Can process

<b>Understanding</b>	Typically reliant on programming and human	Can understand nuanced data as well as
----------------------	---	---



As you can see,AGI will be a very powerful system with huge potential, but it also poses a huge risk according to many analysts and technology experts.

We can expect the lines to blur in the coming years between AI and AGI as systems become more sophisticated, requiring less and less human intervention and oversight.

Elon Musk has recently **sounded the alarm** about the dangers of AI, and others have gone as far as to say it could trigger an **eventual extinction event**.

Even though such concerns are regarded as premature and extreme by some, it's better to be cautious in these types of areas. A 'runaway snowball effect' is easy to envision with intelligent systems that can exponentially improve and iterate in no time at all without the need for human intervention.

It is important to remember that despite the risks,AI and AGI have the potential to do a lot of good. Recently it was announced that scientists have used AI to help discover **new antibiotics that help treat superbugs**.

It is exciting to think about what other breakthroughs can be made possible in the healthcare sector as a result of AI.

No need to worry about the philosophical, societal or economic implications of AGI just yet — we're still a ways away from having such systems that are fully capable of being thought of as true AGI. For now, the focus is likely to remain on using Chatbot AI tools like ChatGPT to save you time, money, and assist with creative endeavours.

**HOW TO GET THE MOST OUT OF GPT-4 NOW WITH CHATGPT-4, AND UNLOCK ITS FULL POTENTIAL**

To get the most out of GPT-4, you will need to know how to word and phrase your inputs to get the expected outcome. These inputs are what's known as **prompts** and there is a whole field of study around this called **prompt engineering**. You'll also need access to ChatGPT-4 through **ChatGPT Plus**.

Choosing the right prompts can dramatically improve the results you are able to get from ChatGPT-4, saving time, and improving the overall quality.

Here are some incredibly useful examples describing how users are using prompts for ChatGPT-4 currently:

- Plagiarism checking
- Language translation
- Writing assistant (for authors or content creators)
- Brainstorming



- Creative design assistant
- Marketing assistance
- Data analysis
- Code evaluation and writing
- See the full list here –

With the introduction of new use cases, prompts, bots and plugins, the list goes on and GPT-4 is quickly becoming the go-to tool for a wide range of professionals spanning multiple industries and sectors.

We have written a guide on [how to use Chat GPT-4 prompts for marketing](#), which is a good read if you are looking to utilise GPT-4 for any kind of marketing!

It's important to realise that ChatGPT-4 is more than just a chatbot that can answer prompts. It becomes even more powerful when using web browsing and plugins for accessing real-time results and undertaking specific functions like SEO, financial analysis, and much more.

## WEB BROWSING

To unlock the full potential of ChatGPT-4, web browsing capabilities are essential. Imagine the future of AI where ChatGPT-4 can browse the web to gather the latest data and analyse the data with real AGI capabilities to provide actionable insights or automated workflows instantly.

This browse feature is a stepping stone in allowing AI to access real-time information from the internet, making it invaluable for tasks like market research, competitive analysis, news analysis, and fact-checking. Initially made available through ChatGPT-4's Browse with Bing, native web browsing was temporarily removed. At the time of writing this update, the [feature is now available again](#) to ChatGPT Plus users.

## CHATGPT-4 PLUGINS

Plugins are another avenue to enhance ChatGPT-4's capabilities. These add-ons can perform specialised tasks for a massive range of applications. For instance, a plugin could analyse your website's SEO performance and suggest improvements, or another could assist in creating financial forecasts for your business. Probably one of the most common applications is web browsing, with plugins like [BrowserPilot](#) and [WebPilot](#) offering an alternative to Browse with Bing.

As the AI landscape evolves, we can expect a surge in the variety and complexity of plugins, making ChatGPT-4 an even more powerful tool for everyday users and professionals across industries.

## ADVANCED DATA ANALYSIS (FORMERLY CODE INTERPRETER)

The future of AI is especially exciting when we can see how powerful ChatGPT-4 is in its current form using Advanced Data Analysis ([formally Code Interpreter](#)). Imagine a plugin that can not only understand but also write and evaluate programming code. This would be a game-changer for developers, data scientists, and analysts. Well, this is what Code Interpreter could do, and very effectively too. So

much so that many developers are already using it to speed up their coding workflows.

Powered by GPT-4, Code Interpreter could do so much more than coding, which is the main reason why it was rebranded to Advanced Data Analysis. With its wide range of Python libraries, ability to upload multiple files, and provide answers based on natural language prompts, there's not much it can't do.

For example, some popular use cases right now are:

1. **Data extraction from PDFs:** Read and analyse data from a PDF document.
2. **Text parsing:** Uses Python's regular expressions (regex) to match and extract details, illustrating its ability to handle complex string manipulations.
3. **Data aggregation:** Correctly aggregating data from a range of different sources and even document types.
4. **Real-time data analysis:** Assist in real-time data analysis, automating repetitive tasks.
5. **Educational support:** Help in learning and teaching programming.
6. **Debugging:** Debug code and handle complex errors.
7. **Mathematical calculations:** Perform complex math operations.

8. **Data insights:** Analyse raw business data and output reports and insights.
9. **Charts:** Create charts and graphs using structured and unstructured data
10. **Code testing:** Run and test code in a sandbox, firewalled environment.
11. **Natural Language Processing:** Coding using natural language, allowing even non-programmers to harness the power of code.
12. **Code experimentation:** A quick and easy way to experiment with code snippets

If the above list wasn't impressive enough, we've recently written about how Screaming Frog's SEO Spider tool and Advanced Data Analysis can be used to **scrape entire websites into Excel form** and even **convert bulk Excel entries to individual Word documents** using ChatGPT-4 to provide detailed recommendations and analysis.

Remember, the key to leveraging these advanced features of ChatGPT-4 is prompt engineering. The better you phrase your prompts, the more accurate and useful the AI's responses will be. Albeit not AGI, with the right prompts and plugins, ChatGPT-4 is a powerful and indispensable asset for any business.

**ARTIFICIAL INTELLIGENCE IN 2024 — THE NEXT 12 MONTHS**

2023 has been a fantastic year so far for **OpenAI** with its release of ChatGPT and we believe 2023 will mark the **tipping point for AI**.

In addition to the success of ChatGPT, OpenAI's image generator tool called **DALL-E** has become a *huge* success too, along with other tools like **Midjourney** and **Stable Diffusion**.

Surpassing 1 million users in just 5 days, ChatGPT holds the record for the **fastest-growing platform in history**. With a platform that grows so fast, a question that inevitably comes to mind is where do we go from here, and what does the future of AI look like 12 months from now?

## 10 POSITIVE PREDICTIONS

1. More revisions of GPT-4 with improved server capacity, increased token counts, faster response times, and general capability improvements.
2. New **ChatGPT plugins** will come onto the scene every day, including **plugins for WordPress, AI content creators**, and other external platforms using **OpenAI's APIs**.
3. Further innovations in the open source race for AI and projects like LLaMA becoming more popular.
4. Deeper integration between AI, blockchain and cryptocurrencies, with more AI-blockchain applications becoming available.
5. Deeper integration between AR, VR and AI and potentially AI capabilities will be announced in future releases of **Meta's**

**new Ray-Ban smart glasses** and **Apple's Vision Pro** product which is expected to be released in early 2024.

6. Greater application of AI within the retail and eCommerce industry, including shopper tracking, AI-led personalisation, and smarter inventory management.
7. The battle for search – rivalry between the search engine giants (Google and Microsoft) is **likely to heat up** as AI plays a more central role through Microsoft's Bing and Google's Bard or **Magi project**.
8. Significant change and application of AI within the manufacturing and healthcare sectors.
9. More advanced features will be made available through the release of GPT-5, which we believe will be released in 2024.
10. AGI will be officially announced in 2025 but possibly sooner.

## 4 NOT SO POSITIVE PREDICTIONS

Sadly, it's not all good news. We also predict the following:

1. An influx of AI-generated fake content flooding the internet, email, and TV, consequently creating mass confusion over what's real and what's not.
2. More students turning to AI as a means to write essays, provide answers and cheat the system.

3. An increased **threat perceived to democracy** ahead of upcoming elections around the world.
4. Greater regulation and laws being enforced around the use of AI.

It's widely expected that we see GPT-5 around the end of 2023 or early 2024 but there's speculation that this will be delayed based on **what has been said by the team at OpenAI**, which mainly appears to be a response to regulation concerns and requests to delay the development of advanced AI like GPT-4.

## DOES TRUE AI, AGI OR GPT-5 AGI EXIST ANYWHERE RIGHT NOW?

Artificial General Intelligence (AGI) refers to machines capable of understanding, learning, and applying knowledge across a wide range of tasks, essentially mimicking human cognitive functions. While there are ongoing discussions and developments in the field, companies like Google's DeepMind are suggesting that AGI could be **just a few years away**, the question of "what is AGI?" and whether it currently exists is still up for debate. It's widely believed that GPT-5 AGI will be possible but the mysterious claims by Jimmy Apples have added fuel to this discussion, suggesting that AGI might already be a reality, at least internally at OpenAI.

We also have exciting advanced AI applications being developed like **AutoGPT and BabyAGI**, which bring us much closer to the idea of AGI.

## THE ENIGMA OF JIMMY APPLES

Jimmy Apples has become a focal point in the AGI discussion due to his series of accurate predictions about OpenAI's projects. His sudden disappearance from social media platforms after sharing an image has only intensified the speculation. Many believe that his actions indicate that AGI has been achieved internally and is being kept under wraps for now. Some believe he is a sort of informant or whistleblower, while others think it could be an elaborate publicity gimmick by OpenAI's marketing team.

## KEY EVENTS AND PREDICTIONS IN "AGI HAS BEEN ACHIEVED INTERNALLY? STORY AND JIMMY APPLES CLAIMS

If you don't fancy watching this interesting video from [@AIAdaExplains](#), here's the breakdown:

- **September 18:** Jimmy Apples tweets "AI has been achieved internally." The tweet goes largely unnoticed.
- **Reddit Investigation:** A group of Reddit users familiar with Jimmy's accurate past predictions about OpenAI decided to investigate further. They find evidence supporting his credibility.
- **Viral Attention:** After gaining viral attention, Jimmy Apples posts an image that fuels speculation. He then deletes his Twitter and Reddit accounts, leading many to believe he revealed too much.
- **March 4 & 14:** Jimmy predicts the announcement date for GPT-4, which turns out to be accurate. This defies even specialized prediction platforms.

- **April 28:** Jimmy predicts a new OpenAI project called GOI. The prediction is confirmed on September 19, 2023.
- **September 10:** Jimmy tweets about “Chat GPT plus referrals coming soon.” This is later confirmed to be accurate.
- **OpenAI Employee Behavior:** Reddit users notice unusual tweets from OpenAI employees, adding another layer to the speculation around AGI and GPT-5.
- **Other Predictions:** Jimmy has made other predictions, such as a 1-2 trillion text model-only version of GPT-4 releasing soon, which also turned out to be accurate.
- **Sam Altman’s Involvement:** OpenAI CEO Sam Altman breaks his 7-year Reddit silence to vaguely deny the accusations but adds fuel to the fire with cryptic tweets.
- **Theories about Jimmy:** Various theories emerge about who Jimmy might be, ranging from a scam artist to a legitimate insider at OpenAI.
- **Unresolved Questions:** Despite the intense scrutiny, the true identity of Jimmy Apples and the veracity of his claims about AGI and GPT-5 remain unresolved.

On the one hand, we can see OpenAI’s Sam Altman discussing **AGI as a potential co-worker replacement** and **claiming on Reddit** that “AGI has been achieved internally” but then claims:

“Obviously this is just memeing, y’all have no chill, when AGI is achieved it will not be announced with a Reddit comment.”

– Source:

This captivating tale of Jimmy Apples and Sam Altman’s comments raises important questions about the future of AI, the possibility of AGI, and the role of GPT-5 AGI in this unfolding narrative.

## GPT-5 AGI

GPT-5 has been at the centre of **various reports** claiming it will achieve AGI status. However, there are also conflicting reports suggesting that OpenAI is **not actively working on GPT-5** due to safety concerns. Given the recent speculations and the track record of Jimmy Apples, it seems increasingly likely that GPT-5 may already possess AGI capabilities, although its public release remains a contentious issue.

## AUTOGPT: A STEP FORWARD, BUT NOT AGI

AutoGPT is **described as** one of the first examples of GPT-4 running fully autonomously, pushing the boundaries of what is possible with AI. While this is a significant advancement, being autonomous doesn’t necessarily mean it possesses the broad, human-like intelligence that defines AGI.

## BABYAGI: CLOSE BUT NOT QUITE

BabyAGI is **referred to** as an autonomous AGI agent leveraging cutting-edge technologies. Despite these claims, it’s primarily described as an AI-powered task management system, which suggests it’s designed for specific tasks rather than exhibiting broad, human-like intelligence.

While there are significant advancements in the field of AI, definitive evidence for the existence of true AGI or GPT-5 AGI is still lacking. The

mysterious actions and predictions by Jimmy Apples have reignited the debate, making the future of AI and the role of GPT-5 in AGI a subject to watch closely.

## ARTIFICIAL INTELLIGENCE BEYOND 2024

AI has changed so fast in the last 12 months that it's hard to imagine what the future of AI will be like in 2025, let alone 5 or 10 years from now.

Will we see stricter regulation and enforcement regarding the applications of AI? Will AI be banned as a result of ethical concerns over increasingly intelligent systems? Things are certainly going to change drastically in the coming years, so let's cover what we can expect to see initially.

## AGI AND EVENTUAL HUMAN AUGMENTATION

As surreal as it sounds, we aren't *lightyears* away from human-AI augmentation. With the likes of **Neuralink** – Elon Musk's brain-interface project – combined with breakthroughs in the AGI space, it won't be long until we can *augment* and *enhance* our cognitive abilities via artificial systems.

Neuralink currently focuses on trying to treat patients that have issues with communication by placing an implant inside, or on, the brain. Early tests have been looking promising and the company has been **approved to start human trials** recently.

It is easy to imagine a time when Neuralink can be inserted into the skull in order to enhance human capability rather than being used to fix cognitive or communication problems.

## MORE CAPABLE ROBOTS AND AI HARDWARE

We have seen the **Japanese robots** that exist in some hotels (although they are currently controlled by humans). However, we are starting to see hotels appearing such as **Henn na Hotel Asakusabashi** where robots and AI play a key role in running the business and serving guests.

Despite still being a gimmick with some utility and functionality, we can expect to see a more comprehensive implementation of robots in the coming years where robots are able to operate with complete autonomy.

## ASI – WHAT IS ARTIFICIAL SUPER INTELLIGENCE?

If things weren't confusing enough with terms like ANI and AGI being used to describe AI, we thought we would throw another one out there – ASI (Artificial Super Intelligence).

ASI refers to a level of artificial intelligence that surpasses human intelligence in virtually all economically valuable work. This not only includes intellectual capabilities, but also the potential to exceed human ability in areas of emotional intelligence, decision-making, and creativity.

Essentially, ASI would outperform the best human brains in practically every field, including scientific creativity, general wisdom, and social skills.

In contrast with AGI, which is comparable to human intelligence and can carry out human-level tasks, ASI goes a step further. An ASI system wouldn't just replicate human decision-making; it would be capable of making decisions that humans haven't even considered.

Right now, ASI is purely hypothetical and highly speculative. However with the rate of innovation and change taking place currently within the field of AI, we can easily see a future where ASI is possible possibly even not more than 10 years away.

## THE FUTURE OF AI: CONCLUSION

AI remains a complex subject, with terms like ANI, AGI, ASI, GPT-4, and GPT-5 often causing confusion. Adding to the intrigue, the question of "what is AGI?" becomes even more pertinent. For a simple explanation of [what is AI and how does ChatGPT work](#), please feel free to check out our recent article below which explains this complex subject as a children's story:

Regardless of how complex this subject is, the future of AI is certainly very exciting and we can expect change to happen at an unparalleled level over the coming years.

Whilst it feels like we have true AI right now with claims being made that ChatGPT, GPT-4 and tools like AutoGPT and BabyAGI are AGI, this sadly isn't the case. True AI can only be defined as a system that possesses human-like intelligence and can operate autonomously and

across a broad range of tasks, at the same level as a human (AGI) or better than a human (ASI).

From our perspective, it seems very likely that GPT-5 will be capable of AGI. We initially predicted that it probably already is behind the scenes, but when or even whether an AGI version gets released is up for debate. In light of recent speculations, notably from the enigmatic figure Jimmy Apples, the debate around the future of AI and the existence of AGI has intensified. His sudden disappearance from social media after fueling these speculations adds another layer of intrigue to the discussion. Given these developments, it seems increasingly plausible that GPT-5 may already include AGI capabilities internally, although its public release remains uncertain.

The topic of true AI and whether we'll see AGI unveiled in the coming year(s) (or 2025 as predicted by Jimmy Applies) is a question that policymakers, industry leaders, and governments will likely decide. If it's not here already, it will be very soon.

**What do you think about AI and AGI? Do you have any thoughts about the future of AI? Will it be a force for good or a dangerous threat we should be cautious of? Will we see AGI happen any time soon, or are we many years away with policymakers delaying progress? Please let us know in the comments section below or on social media. Research**

## When will singularity happen? 1700 expert opinions of AGI [2023]

- Understand the results of major surveys of AI researchers in 2 minutes
- Keep in mind that AI researchers were over-optimistic before
- Understand why reaching AGI seems inevitable to most experts
- Understand why some believe that we will not reach AGI
- To learn more about Artificial General Intelligence

[Share article](#)



Artificial intelligence scares and intrigues us. Almost every week, there's a new AI [scare](#) on the news like developers afraid of what they've created or shutting down bots because they got too intelligent. Most of these [AI myths](#) result from research misinterpreted by those outside the field. For the fundamentals of AI, [feel free to read our comprehensive AI article](#).

The greatest fear about AI is singularity (also called Artificial General Intelligence), a system capable of human-level thinking. According to some experts, singularity also implies machine consciousness. Regardless of whether it is conscious or not, such a machine could continuously improve itself and reach far beyond our capabilities. Even before artificial intelligence was a computer science research topic, science fiction writers like Asimov were concerned about this and were devising mechanisms (i.e. Asimov's Laws of Robotics) to ensure the benevolence of intelligent machines.

For those who came to get quick answers:

- Will singularity ever happen? According to most AI experts, yes.
- When will the singularity happen? Before the end of the century. The consensus view was that it would take around 50 years in 2010s. After the advancements in [Large Language Models \(LLMs\)](#), a leading AI researcher, [Hinton](#), updated his view and believes that it could take 20 years or less.

The more nuanced answers are below. There have been several surveys and research of AI scientists asking about when such developments will take place.



Understand the results of major surveys of AI researchers in 2 minutes

We looked at the results of 5 surveys with around 1700 participants where researchers estimated when singularity would happen. In all cases, the majority of participants expected AI singularity before 2060.

*Source: Survey distributed to attendees of the Artificial General Intelligence 2009 (AGI-09) conference*

In the 2022 Expert Survey on Progress in AI, [conducted](#) with 738 experts who published at the 2021 NIPS and ICML conferences, AI experts estimate that there's a 50% chance that high-level machine intelligence will occur until 2059.

Older surveys had similar conclusions. In 2009, 21 AI experts participating the in AGI-09 conference were [surveyed](#). Experts believed AGI will occur around 2050, and plausibly sooner. You can see above their estimates regarding specific AI achievements: passing the Turing test, passing third grade, accomplishing Nobel worthy scientific breakthroughs and achieving superhuman intelligence.

In 2012/2013, Vincent C. Muller, the president of the European Association for Cognitive Systems, and Nick Bostrom from the University of Oxford, who published over 200 articles on superintelligence and artificial general intelligence (AGI), conducted a [survey](#) of AI researchers. 550 participants answered the question: "When is AGI likely to happen?" The answers are distributed as

- 10% of participants think that AGI is likely to happen by 2022
- For 2040, the share is 50%

- 90% of participants think that AGI is likely to happen by 2075.

In 2017 May, 352 AI experts who published at the 2015 NIPS and ICML conferences were [surveyed](#). Based on survey results, experts estimate that there's a 50% chance that AGI will occur until 2060. However, there's a significant difference of opinion based on geography: Asian respondents expect AGI in 30 years, whereas North Americans expect it in 74 years. Some significant job functions that are expected to be automated until 2030 are: Call center reps, truck driving, and retail sales.

In 2019, 32 AI experts participated in a [survey](#) on AGI timing:

- 45% of respondents predict a date before 2060
- 34% of all participants predicted a date after 2060
- 21% of participants predicted that singularity will never occur.

AI entrepreneurs are also making estimates on when we will reach singularity and they are a bit more optimistic than researchers:

- Louis Rosenberg, computer scientist, entrepreneur, and writer: 2030
- Patrick Winston, MIT professor and director of the MIT Artificial Intelligence Laboratory from 1972 to 1997: He mentioned 2040 while stressing that while it would take place, it is a very hard-to-estimate date.
- Ray Kurzweil, computer scientist, entrepreneur, and writer of 5 national best sellers including [The Singularity Is Near: 2045](#)

- Jürgen Schmidhuber, co-founder at AI company NNAISENSE and director of the Swiss AI lab IDSIA: ~2050

### Keep in mind that AI researchers were over-optimistic before

Examples include:

- AI pioneer [Herbert A. Simon](#) in 1965: “machines will be capable, within twenty years, of doing any work a man can do.”
- Japan’s Fifth Generation Computer in 1980 had a ten-year timeline with [goals](#) like “carrying on casual conversations”

This historical experience contributes to most current scientists shying away from predicting AGI in bold time frames like 10-20 years. However, just because they are more conservative now doesn’t mean that they are right this time around.

### Understand why reaching AGI seems inevitable to most experts

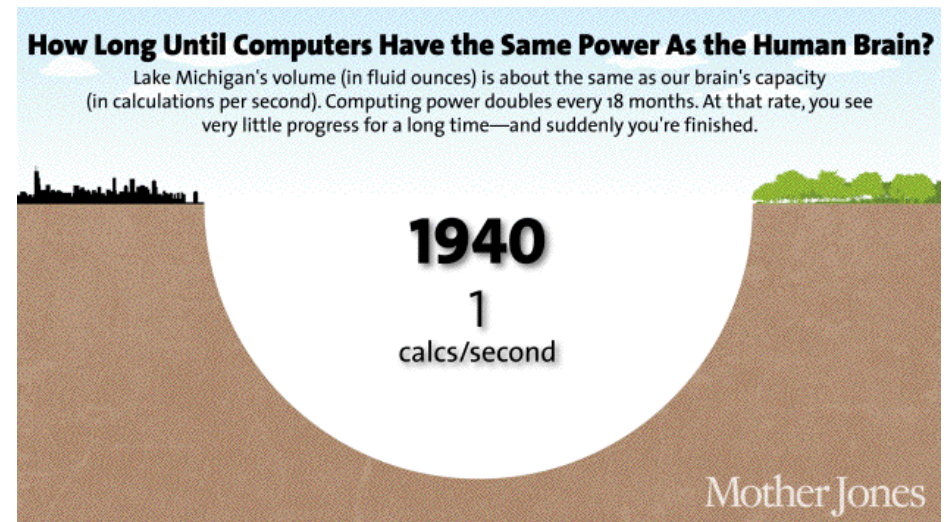
These may seem like wild predictions, but they seem quite reasonable when you consider these facts:

- Human intelligence is fixed unless we somehow merge our cognitive capabilities with machines. Elon Musk’s neural lace startup aims to do this but research on [brain-computer interfaces](#) is in the early stages.
- Machine intelligence depends on algorithms, processing power, and memory. Processing power and memory have been

growing at an exponential rate. As for algorithms, until now we have been good at supplying machines with the necessary algorithms to use their processing power and memory effectively.

Considering that our intelligence is fixed and machine intelligence is growing, it is only a matter of time before machines surpass us unless there’s some hard limit to their intelligence. We haven’t encountered such a limit yet.

This is a good analogy for understanding exponential growth. While machines can seem dumb right now, they can grow quite smart, quite soon.



Source: Mother Jones

## **If classic computing slows its growth, quantum computing could complement it**

Classic computing has taken us quite far. AI algorithms on classical computers can exceed human performance in specific tasks like playing chess or Go. For example, [AlphaGo Zero](#) beat AlphaGo by 100-0. AlphaGo had beaten the best players on earth. However, we are approaching the limits of how fast classical computers can be.

Moore's law, which is based on the observation that the number of transistors in a dense integrated circuit double about every two years, implies that the cost of computing halves approximately every 2 years. However, most experts believe that Moore's law is coming to an [end](#) during this decade. Though there are efforts to keep improving [application performance](#), it will be challenging to keep the same rates of growth.

[Quantum Computing](#), which is still an emerging technology, can contribute to reducing computing costs after Moore's law comes to an end. Quantum Computing is based on the evaluation of different states at the same time whereas classical computers can calculate one state at one time. The unique nature of quantum computing can be used to efficiently train neural networks, currently the most popular AI architecture in commercial applications. AI algorithms running on stable quantum computers have a chance to unlock singularity.

For more information about [quantum computers feel free to read our articles on quantum computing](#).

## **Understand why some believe that we will not reach AGI**

There are 3 major arguments against the importance or existence of AGI. We examined them along with their common rebuttals:

I- Intelligence is multi-dimensional

Therefore, AGI will be different, not superior to human intelligence.

- This is true and human intelligence is also different than animal intelligence. Some animals are capable of amazing mental feats like squirrels remembering where they hid hundreds of nuts for months.
- [Yann LeCun](#), one of the pioneers of deep learning, believes that we should retire the word AGI and focus on achieving "human-level AI".<sup>1</sup>  
He argues human mind is specialized and intelligence is a collection of skills and the ability to learn new skills. Each human can only accomplish a subset of human intelligence tasks.<sup>2</sup>  
It is also hard to understand the specialization level of human mind as humans since we don't know and can't experience the entire spectrum of intelligence.
- In areas where machines exhibited super-human intelligence, humans were able to beat them by leveraging machine-specific weaknesses. For example, in 2023 an amateur was able to [beat a go program](#) that is on par with go programs that [beat world champions](#) by studying and leveraging the program's weaknesses.

However, these differences do not stop humans from achieving far more than other species in terms of many typical measures of success for a species. For example, homo sapiens is the species that contribute **most** to the bio-mass on the globe among mammals.

*Source: Kevin Nelly*

## 2- Intelligence is not the solution to all problems

For example, even the best machine analyzing existing data will probably not be able to find a cure for cancer. It will need to run experiments and analyze results to discover new knowledge in most areas.

This is true with some caveats. More intelligence can lead to better-designed and managed experiments, enabling more discovery per experiment. History of research productivity should probably demonstrate this but data is quite noisy and there are diminishing returns on research. We encounter harder problems like quantum physics as we solve simpler problems like Newtonian motion.

## 3- AGI is not possible because it is not possible to model the human brain

Theoretically, it is possible to model any computational machine including the human brain with a relatively simple machine that can perform basic computations and has access to infinite memory and time. This is the Church-Turing hypothesis laid out in 1950. It is universally accepted. However as stated, it requires certain difficult conditions: infinite time and memory.

Most computer scientists believe that it will take less than infinite time and memory to model the human brain. However, there is not a mathematically sound way to prove this belief as we do not understand the brain enough to exactly understand its computational power. We will just have to build such a machine!

And we haven't been successful, yet. For example, the [ChatGPT large language model](#) launched in November/2022 caused significant excitement with its fluency and quickly reached a million users. However, its lack of logical understanding makes its output error-prone. For a more dramatic example, this is a [video](#) of what happens when machines play soccer. It is a bit dated (from 2017) but maHello, Achieving the singularity from where we are now is relatively a simple jump, it is just time and advancements combined with a team somewhere who is dedicated to it and has the money to pull it off. The missing part of the equation would be asking the question "what is consciousness?" and understanding that. Then, understanding how to model that with non-biological machinery even at small levels, like modeling the consciousness of an amoeba or more advanced things like snakes and squirrels. Then if we know for certain what it is and how to model it, just run an adaptive evolution algorithm on itself, modeling out all of the processes in human cognition until it can beat them everywhere. Then, allow it to simply rebuild itself to continuously improve.

The problem currently preventing this, is that human beings have no idea what consciousness is at all. It is a great mystery. One person thinks it is in the brain. Another thinks the brain is like a tuning fork, channeling the consciousness from somewhere else. It is a great mystery in science. When this problem is solved, then machine consciousness can be built most likely, depending on what it actually is.

If consciousness is something weird, such as “human beings have spirits in other dimensions that are planned for their bodies by a supreme being. The brain creates a quantum resonant frequency that links it together with this already conscious entity, and then several universes are interacting simultaneously to create the actual experience of being self aware and sentient” well then, it will be very difficult to design a machine that does that same thing. It is more likely that we figure out how to model the resonance in the brain and then transfer an already existing consciousness of an animal or a human into a machine and keep it going, if that even makes any sense at all.

However, maybe that’s not how it works, and it is something simple like the holographic connection of energy patterns fluctuating in the mind – this can be modeled and a machine can be built that does these sorts of things with much more efficiency. Right now the mystery of the problem is consciousness itself.

Hope that helps. I really enjoyed the robot soccer tournament. I also feel like a superhero at soccer now.

## **Navigating the New Risks and Regulatory Challenges of GenAI**

### **Summary.**

The use of generative AI promises to continue to grow rapidly. Consequently, leaders must understand the risks and challenges of this new technology and develop policies and practices to guide its usage. This article explains the areas of concern and offers...more

- 

The rapid rise of generative AI, including large language models (LLMs) such as , is creating new risks and regulatory challenges for business. Although it is still early days, companies cannot afford to delay developing policies and practices regarding the use of these technologies.

What new risks do these technologies pose, particularly as their users may rely on them for health, legal, or other professional services as well as business decisions? And how can both the developers building these tools and the companies using them assess and mitigate the risks? In this article, we provide some guidance.

### **Proprietary Information Leaks**

Earlier this year, Samsung that its employees had accidentally shared confidential data with ChatGPT — meaning that the company’s proprietary information could be used to further train OpenAI’s model and potentially be revealed to other users. Similarly, with some clever prompt engineering, users convinced Microsoft’s AI-powered chatbot to share information . Despite current safeguards in place, it’s clear that LLMs have the potential to pose substantial risk with respect to confidential or sensitive information that passes through these systems.

Addressing this risk requires joint efforts by both users and developers of generative AI tools. For example, guidelines for the prompts employees use as inputs to generative AI tools residing outside the company boundaries must be considered, and tools that alert employees when they are about to send a prompt that may include

sensitive company information to a third-party generative AI system may need to be deployed.

Moreover, when a company fine-tunes existing — that is, core AI models currently mostly available from big tech companies that can be adapted for multiple downstream applications — with their own data, it should double down on data governance and prioritize visibility into the quality and clarity of the provenance of any data used, especially if the company works with external providers to do that fine-tuning.

Companies may also want to consider creating a so-called “sandbox” to allow employees to explore the capabilities of generative AI tools without sharing their prompts or the data with the developers. , for example, set up such an environment where users can easily switch between different LLMs through a single interface without having prompts or any data inputs being shared with the LLM vendors. Such approaches are not without trade-offs: For example, not sharing such information with the developers could potentially limit how well the generative AI can be fine-tuned for the specific needs of the company.

Developers of these technologies also need to undertake careful due diligence with respect to both the data and the data providers used to train these AI models. In some cases, this may mean training models only on well-defined data sources and always carefully reviewing the provenance of the data that underlies a given tool or that passes through a tool during its usage.

For example, Getty recently to develop generative AI tools that would be trained on fully licensed content, enabling the company to ensure that the content creators who own the rights to the images used to train these models are able to get royalties from artificially generated images. Perhaps more importantly, the Getty approach promises those using the system protection from lawsuits claiming copyright infringement on the output of the generative AI system due to the provenance of its training data.

## **Inaccurate or Harmful Outputs**

Generative AI is trained on a given data set, and there’s no easy way to trace back the source of an output to a specific input or to instruct the model to “forget” any problematic, sensitive, or illegal data on which it may have been trained (although exciting new research on how to to control their behavior is ongoing). As a result, these tools run the risk of creating outputs that are inaccurate or otherwise harmful, potentially at a substantial cost: When Google’s AI chatbot made a in its first demo, the company’s valuation dropped by more than \$100 billion. Hallucinations, misleading content, and other factual errors that make their way into LLM outputs range from amusing mistakes to costly and downright costly or even dangerous misinformation.

In response, developers and users alike need to implement monitoring and feedback processes to ensure the quality of the outputs generated by these technologies and to continuously improve them. In addition, companies also need to monitor the quality of the final work produced when employees use these technologies. While use of, say, LLMs can significantly improve the quality of the work — as by a

team of people from Harvard, MIT, the University of Pennsylvania, and the Boston Consulting Group shows — quality may actually deteriorate for some tasks. What if, for example, ChatGPT leads to worse employee performance or hurts the quality of decisions and services?

To ensure proper governance, including rigorous monitoring and continuous improvement processes, companies will also have to decide what level of internal transparency is best — or necessary — when using these technologies. There is a spectrum of approaches business leaders can take: from explicitly not constraining (and even encouraging) their employees to use generative AI to defining guidelines for usage (which may be suggestive and unenforceable) to setting up more-heavy-handed processes to detect and regulate usage.

As a side note, a hands-off approach isn't necessarily a bad idea. In some applications, it may make sense to focus on the quality of the output rather than on exactly how that output was produced. We do not regulate the use of calculators, slide rules, treatises, and other tools; instead, we monitor the quality of the work accomplished with those tools.

Similarly, if it proves possible to put fact-checking or other systems in place to ensure that outputs are accurate, free from hallucinations, and avoid other pitfalls of AI-generated content, then there may not be as strong a need for employees to disclose that an AI tool was used in the course of their work. There are also contextual factors at play: In some applications, occasional errors may be acceptable, whereas in others, there may be limited or no margin for error. The level of risk can

determine whether generative AI can be used in specific business cases.

Another consideration that will inform what approach to take is technical limitations. For example, many education leaders have [redacted] that it will be very difficult to detect cheating by students using ChatGPT to write essays or complete assignments. While [redacted] and training programs are emerging to help people detect AI-generated content, there are many applications in which enforcement of restrictions on the use of generative AI remains a challenge.

In fields like these, it may be especially important to either intentionally take a more hands-off approach (when the risk of harmful outputs is minimal) or to complement technical solutions with other forms of trust signaling and quality control such as certification or audits by reputable third parties (in situations where it's more important to avoid certain types of harmful content).

## Potential New Liabilities

The potential for harmful or inaccurate content in turn drives a whole host of new liability risks when using generative AI tools in business. As tools like GPT-4 demonstrate the ability to pass professional exams and perform certain tasks on par with humans in fields such as [redacted] and [redacted], they're increasingly likely to be incorporated into real-world applications. And while this certainly creates new opportunities, it also creates new risk as companies may be held liable for any harmful content or unsafe decisions these tools help them make.

For example, ChatGPT has been shown to be effective at producing first drafts of documents such as contracts, wills, and complaints. But risks of errors can increase when, say, a lawyer uses ChatGPT to draft a will for a client but does not notice that ChatGPT's output includes provisions that are barred in the client's state — meaning that the will won't be enforceable. Or, say, if a lawyer uses ChatGPT to draft a complaint for a contract dispute and it hallucinates details about the case that are not true. In situations like these, lawyers can be subject to disciplinary action, including disbarment, and their firm may be subject to legal action.

Similarly, LLMs can be used to help physicians diagnose patients or to help patients learn about medical issues. Patient-facing mental health related chatbots are also hitting the market. But what happens if the chatbot gets it wrong and a patient suffers as a result? Normally, if doctors make mistakes, they can be sued for medical malpractice. But it's less clear today whether the technology or health care provider would be held legally liable in a case of AI-driven malpractice (such as due to the use of a chatbot) or, for that matter, whether medical malpractice insurers would pay out in the case of such a lawsuit. This is particularly challenging with generative AI as its outputs are not easily traced back to specific data or data providers.

Liability in the medical context is further complicated by the notion of a "standard of care." In medicine, malpractice is defined as deviation from what a reasonably skilled, competent, and educated medical provider would have done under the same treatment circumstances. Today, that definition would deem excessive reliance on an LLM as a problematic deviation from the standard of care. But there may come a time when the standard of care changes to incorporate some amount

of (responsible) generative AI usage, potentially creating legal risk associated with choosing *not* to use these tools alongside the risks that come with using them.

Professionals and companies will need to consider a number of difficult questions that may arise due to reliance on the output generated by these technologies. What happens if potential licensure issues arise when non-professionals use LLMs to generate professional documents? Some uses of generative AI in law might be *unethical* or *unlawful* of law, leading to sanctions. What role do the users versus makers of generative AI have in policing the boundaries of how these models are used? What about intermediate users such as legal aid services, who make such tools available to clients and/or train those clients on how to best use the software?

To be sure, as there are no cut-and-dry answers, professionals and organisations would be wise to consult legal experts and carefully determine the best way to mitigate liability risk in their unique business environment. Laws are also likely to evolve as these technologies become more widely used, and as new risks — and new legal cases — are identified. But no matter what, providers and users of these technologies need to consider all of these new complex liability issues and either avoid them entirely or take proper insurance and/or risk-mitigation measures.

## Regulatory Risks

The speed of innovation is so fast that generative AI applications can violate digital regulations as soon as those come into effect. For example, LLMs and foundation models are already exposing and testing



the limits of regulations including the EU's [Digital Services Act](#), which was recently adopted to ensure trust and safety online, as well as the EU [AI Act](#).

Clearly, regulations governing the use of AI are still evolving. But as these laws expand to encompass new generative AI tools, companies relying on the large-scale generation and sharing of AI outputs may face new regulatory hurdles. For example, on the IP front, many litigations are already pending related to copyright concerns from artists and creators whose content has been used to train these models. Firms using tools built on questionably-sourced data may find themselves unwittingly in violation of copyright and other regulations as these legal structures mature.

In light of this complex and rapidly-changing regulatory landscape, companies should be vigilant about adopting the appropriate protocols and safeguards to ensure that these technologies are used effectively, responsibly, and legally. Any decisions about the use of such technologies — including when, by whom, how, and for what purpose they can be used — need to be made dynamically and at a meaningful level of granularity.

For example, many recent EU laws follow a risk-based approach, imposing increasing constraints on the conditions under which AI can be used depending on the potential risks it can engender. Companies may need to consider similar risk-based approaches, not only taking into the account the risks regulators consider, such as safety or impact on people's livelihood, but also potential quality, operational, reputation, and other business risks. Moreover, protocols such as reliance on pre-

release red-teams and ex-post content moderation can further help anticipate misuse of these tools.

Of course, as regulations evolve, new requirements are likely to arise. In particular, one area in which new laws are still being developed is external disclosure that AI is being used, in line with earlier privacy frameworks such as the EU's [GDPR](#).

. If your customer service portal uses an LLM-powered chatbot, are you obliged to tell your customers? If the consulting advice you've prepared was informed by input from an LLM, do your clients need to know?

The approach to [disclosure](#) taken in the medical and legal fields may offer some guidance for businesses in industries where disclosure isn't yet a legal requirement. In layman's terms, the legal requirement for physicians is that they must disclose anything that could reasonably influence a patient's decision to accept a recommended medical procedure. For example, some courts have held that physicians are legally required to tell their patients if a procedure will be performed by a substitute surgeon, since this could reasonably lead patients to change their mind about moving forward with the surgery.

For companies looking to adopt a similar approach, it may make sense to follow a similar principle. For example, if you know that an average consumer's decision to buy your product or service would be influenced by the knowledge that it uses AI that may pose safety dangers, significant economic costs, or other risks to its users, you should consider disclosing that usage.

For example, the mental health app Koko found that while ChatGPT helped its volunteers write messages faster, the messages were when people knew they were talking to a bot. As a result, the company decided to stop using ChatGPT. But in other cases, the knowledge that generative AI is involved may not have any impact on customers' willingness to use a product, so there may be less of an ethical or legal imperative to disclose. Companies will need to ensure they stay on top of new regulations as they emerge, but they can prepare themselves today by following the spirit of other existing regulations related to informed consent and other consumer protections.

### **Competitive Pressure to Get on the Bandwagon**

Despite these many risks, as generative AI becomes increasingly commonplace in a wide range of industries, opting not to use it may become increasingly untenable. If using an LLM can save lawyers several billable hours of work, their clients are likely to pressure them to do so — even if the systems in place to monitor these tools' outputs are still fairly limited.

Indeed, are already advocating that law schools should teach students how to use LLMs, arguing that these tools are likely to become an unavoidable component of the legal profession. In many industries, pressure to cut costs and stay competitive may push professionals to adopt these tools before they truly are ready, with insufficient structures to mitigate any substantial risks they may create. As such, companies will increasingly need to consider how to balance trade-offs between the potentially questionable quality of AI tools'

decisions or outputs and the competitive advantages associated with the speed, efficiency, and scale they enable.

The tradeoffs involved in using AI — such as those between explainability and accuracy, or privacy and security — are not new. One of the key tradeoffs of powerful tools like generative AI is between quality and speed. For example, these technologies have the potential to help meaningfully address the public's enormous unmet civil legal needs. A significant number of middle-income Americans receive no meaningful assistance when facing important civil legal issues such as child custody, debt collection, eviction, and foreclosure. Providing individuals with access to LLMs — for instance to help them draft contracts or wills — could give them a head start before they make use of a limited-time legal aid provider through the “lawyer for a day” programs some courthouses offer. But what is gained in terms of speed and scale may be lost in terms of quality. It may also create externalities: For example, judges may now face seemingly plausible but actually “hallucinatory” legal documents.

Balancing tradeoffs is never easy. Users and developers of these technologies need to decide on minimum quality standards that need to be ensured when generative AI tools are in the hands of people with less training, without excessively sacrificing speed and efficiency. Companies may also need to include proper quality controls and management of breaches of quality standards, possibly in a gradual manner (i.e., potentially being less strict for early proposals and designs and stricter for final products). At the minimum, executives need to determine the relative importance of speed and scale versus quality for each use of generative AI.

## Is your business ready for generative AI?

Currently, generative AI is still mostly used when visiting a particular website and offering a prompt in the case of a chat-based LLM or providing a seed image or prompt or both in the case of image-based generative AI. But as major generative AI companies are rapidly pushing towards much more full-scale integration into existing familiar products, we may not be far off from a moment where generative AI will be ubiquitous as, say, how predictive text has become in sending a text message from a mobile phone.

While we are still in the early stages, it is the essential moment to develop an organizational strategy for dealing with generative AI. Executives need to understand both the potential applications of these innovations as well as the new risks they can introduce and adopt tools, processes, and practices that can give their organizations a head start in managing these risks.

## AI & ML - How It Will Affect Engineering's Future

Artificial Intelligence and Machine Learning are two branches of computer science that are closely connected. These two technologies are among the most popular for developing intelligent systems.

Although these are two related technologies that are frequently used interchangeably, they are still distinct names in many situations. On a

broad level, we may distinguish Artificial Intelligence and Machine Learning as:

- Artificial Intelligence (AI) is a larger idea that aims to produce intelligent machines that can replicate human thinking capabilities and behaviour
- Machine learning is an application or subset of AI that allows computers to learn from data without being explicitly programmed.

ML and AI have a bright future because they give machines the power to learn, making them more human-like. ML and AI are presently used in a variety of fields, particularly those related to engineering.

## Future of AI and ML - What Will It Look Like

Machine Learning is beginning to migrate to the cloud as a massive quantity of data becomes more readily available. Data Scientists will no longer write bespoke programmes or maintain infrastructure explicitly. Instead, AI and machine learning will assist systems in scaling, generating new models on the fly, and delivering faster and more accurate results.

Machine Learning and Artificial Intelligence are widely employed in the following industries:

- Financial Trading
- Personal Security
- Online Search
- Healthcare & Fitness
- Sales and Marketing
- Transportation & Conveyance

Artificial Intelligence and Machine Learning have reached a vital tipping point, augmenting and extending practically any technology-enabled service, product, or application. People have worked hard in the post-industrialisation age to construct a machine that behaves like a person.

The thinking machine is AI's greatest gift to humanity; its magnificent entrance has abruptly modified the operating laws of commerce. Self-driving cars, digital assistants, robotic manufacturing workers, and smart cities have all demonstrated that intelligent machines are conceivable.

AI has altered most industrial areas, including retail, manufacturing, finance, healthcare, and media, and it continues to expand.

Since the pandemic, the use of Artificial Intelligence (AI) has skyrocketed as the entire globe has pushed toward digitalisation.

According to research conducted by Oxford University and Yale University, AI will surpass humans in many aspects and will automate all human employment over the next 120 years.

For example, AI may be better at translation than humans by 2024, create best-selling books by 2049, and do operations by 2053.

### **Role of AI & ML in Engineering - A Peek**

Like many other sectors, engineering is being transformed by artificial intelligence and machine learning. However, even though these technologies appear to be everywhere, we must not lose sight of how magnificent they are and the incredible things they enable us to achieve today and in the future.

Engineers' responsibilities may change due to artificial intelligence and machine learning, but it may also allow them to achieve things they couldn't previously.

Artificial intelligence in the engineering sector employs both software and hardware components. As a result, machines will be able to support not just intelligent production lines and challenging manufacturing activities as they get more sophisticated but also create and enhance tasks over time with little or no human intervention via machine learning.

For example, automobile manufacturers have been using robots on the manufacturing line for quite some time, and they have progressed from doing simple technical duties to executing numerous precise motions necessary for some of the most complicated elements of the process.

Many of the activities that engineers are responsible for, such as design and simulation, may be aided by artificial intelligence systems. Consider how, once upon a time, Computer-Aided Design (CAD) was only a supplement to engineering but is now an essential element of the everyday workflow.

These technologies will assist engineers in enhancing their capabilities and allow them to explore design and weight-saving solutions previously unthinkable. Another way AI may help engineers is by automating low-value jobs, allowing engineers to focus on higher-value ones.

Machines will be beneficial in assisting with engineering judgement by utilising machine learning to detect patterns in data. While there are several advantages to using artificial intelligence and machine learning in engineering, some engineers are afraid that robots may usurp their employment.

Automation has and will continue to take over work that people have historically done; nevertheless, this can liberate humans to accomplish higher-level activities and take over positions that require human-specific abilities that do not yet exist.

According to a University of Oxford assessment, scientific and engineering occupations are the least threatened and will profit the most from artificial intelligence capabilities. As AI and machine learning revolutionise the way engineers work, they must be ready to adapt to the latest technologies.

In addition, engineers must optimise the job so that interactions between people and robots are as unobtrusive as possible.

Universities can play a crucial role in educating engineering students on the benefits of AI and ML early on to ensure their preparation for the technology. As it is easy to mould their brains during the learning process, the operation of these technologies can become second nature to them and allow for faster progress in the developing industry.

We here at NMAM-IT offer programs that directly or indirectly teach students about these technologies to prepare them for the transformation of industries.

Visit our website or connect with our experts to know more about AI & ML and how they can be beneficial to your engineering future!

**All vertical industries continue to adopt emerging tools and methodologies, but the impact of generative AI in engineering disciplines stands out from the rest.**



Written by **Jason Perlow**, Senior Contributing Writer

Oct. 19, 2023 at 7:15 a.m. PT

**table of contents**

**How can generative AI and ML be used in software engineering?**

**How can generative AI and ML be used in data engineering?**

**How can generative AI and ML be used in mechanical engineering?**

**How can generative AI and ML be used in civil engineering?**

**How can generative AI and ML be used in electrical engineering?**

**How can generative AI and ML be used in chemical engineering?**

**How can generative AI and ML be used in biomedical engineering?**

**How can generative AI and ML be used in aerospace engineering?**

## How can generative AI and ML be used in environmental engineering?

Yuichiro Chino/Getty Images

Generative artificial intelligence (AI) is proving to be a powerful tool for a broad range of engineering disciplines, offering highly streamlined processes and work products, and providing invaluable insights for industry leaders.

But while the term 'generative AI' is the tech industry's favorite buzzword, what exactly is it? At its core, generative AI is a subset of artificial intelligence that can generate new data, designs, or models based on existing data by using machine learning (ML) components and algorithms. Generative AI's power lies in its ability to optimize and accelerate processes, making it an ideal technology for engineering disciplines that require high precision, efficiency, and innovation.

### **Also: 4 ways generative AI can stimulate the creator economy**



## The Intersection of Generative AI and Engineering

The surge of generative AI can harness tremendous potential for the engineering realm. It can also come with its challenges, as enterprises and engineers alike figure out the impact of AI on their roles, business strategies, data, solutions, and product development. What does the future roadmap look like for bringing generative AI into the software fold? ZDNET decodes from all angles. **Read now**

Each of the major engineering disciplines can apply generative AI toolsets in a similar manner, but also in their own unique ways -- and each field also has unique commercial and open-source solutions they can use to leverage generative AI and ML to their best advantage.

Let's look at nine major engineering disciplines and think about how they might approach using generative AI, including examples of specific

solutions, both commercial and open source. Many of these tools have been used for years, but are now incorporating generative AI features, or have capabilities that continue to be refined by improving their data models or codebases, which their developers train or optimize with commercial and open-source generative AI and ML toolsets and methodologies.

## **How can generative AI and ML be used in software engineering?**

Software engineering is about more than just writing code; it's the art and science of designing, developing, and maintaining software systems that power our societies. It's the discipline that provides the foundational technology for the modern digital world, from mobile applications to the complex algorithms that drive AI.

Software engineering encompasses many activities, including requirements analysis, system design, programming, testing, and maintenance. Generative AI and ML offer transformative solutions that can automate and optimize various aspects of software development, making it faster, more efficient, and more robust.

### **Enabling digital transformation:**

- **Automated code generation:** Commercial tools, such as [OpenAI's Codex](#) (also used in [GitHub Copilot in Microsoft Visual Studio](#)) and open-source platforms like [Sourcery](#), can generate code snippets, reducing development time and errors.

- **Automated testing:** Solutions such as [Testim.io](#) and open-source frameworks like [JUnit](#) can automate testing and ensure robust software quality.
- **DevOps automation:** GitLab's [Auto DevOps](#) and open-source tools like [Jenkins](#) can automate deployment and monitoring, enhancing operational efficiency.

## **How can generative AI and ML be used in data engineering?**

Data engineering is a specialized field that enables data-driven decision-making in organizations. It involves designing, constructing, and maintaining architectures, databases, and large-scale processing systems that transform raw data into actionable insights.

### **Also: Why generative AI so popular: Everything you need to know**

Data engineers ensure data is available, reliable, and in a format that data scientists and business analysts can use for their analyses. As data volume, velocity, and variety grow exponentially, data engineering becomes increasingly complex and vital, requiring disruptive tools that use generative AI and ML to provide velocity and insights on demand.

### **Creating actionable insights:**

- **Synthetic data creation:** NVIDIA's [DataSynth](#) and open-source platforms like [Synthea](#) (for creating test patient health



data) can generate synthetic datasets for robust machine-learning training.

- **Automated schema design:** Open-source tools like [Apache Avro](#) can automate database schema design, streamlining data storage and retrieval.
- **Real-time data handling:** Open-source tools, such as [Apache Flink](#) and [Apache Kafka](#), can optimise real-time data processing, which enables efficient data-stream management.

## **How can generative AI and ML be used in mechanical engineering?**

Mechanical engineering shapes everything from the vehicles we drive to the appliances we use at home. It encompasses designing, analysing, and manufacturing various mechanical systems, from simple mechanisms, such as levers and pulleys, to complex machinery like aircraft engines and robotic arms.

Mechanical engineers work to solve some of the most challenging problems, including how to make machines more efficient, sustainable, and safe. Generative AI is becoming a key optimising technology within the mechanical engineering discipline, offering powerful tools for producing more efficient designs, improving material utilisation, and predicting maintenance needs.

### **The mechanics of everyday life:**

- **Design optimization:** Autodesk's [Generative Design](#) and open-source solutions like [FreeCAD](#) can optimise mechanical designs for various constraints.
- **Material utilisation:** Commercial platforms, including [Altair Inspire](#) (for structural analysis), [Materialise](#) (3D printing for the healthcare industry), and open-source tools like Opencascade [SALOME](#), can optimise material usage, reducing waste and costs.
- **Predictive maintenance:** IBM's [Watson](#) and open-source platforms, such as Python's [scikit-learn](#) machine-learning tool, can forecast mechanical failures, enabling proactive maintenance.

## **How can generative AI and ML be used in civil engineering?**

Civil engineering, a field with ancient roots, is essential for designing and maintaining bridges, roads, and buildings. Civil engineers ensure our communities are functional, safe, and sustainable, tackling complex challenges such as urban development, traffic congestion, and disaster resilience.

### **Also: The ethics of generative AI: How we can harness this powerful technology**

As we face the modern challenges of rapid urbanisation and climate change, the role of civil engineering becomes even more critical. Generative AI is emerging as a transformative technology in this field,

offering innovative solutions for optimising infrastructure design, predicting natural disasters, and efficiently allocating resources.

## Building infrastructure:

- **Infrastructure design:** Bentley's [Generative Components](#) and open source 3D-modeling solutions like [Blender](#) can assist in infrastructure planning and optimising designs based on various constraints.
- **Disaster prediction:** Platforms like [One Concern](#) and open-source tools such as [OpenQuake](#) can predict potential disasters, enabling preventive measures.
- **Resource allocation:** Oracle's [Primavera P6](#) and open-source platforms, such as [GanttProject](#) and [ProjectLibre](#), can optimize the allocation of resources, including labor, materials, and time, ensuring efficient project execution.

## How can generative AI and ML be used in electrical engineering?

Electrical engineering is the driving force behind the technologies that power our modern world, from the electricity that lights up our homes to the electronic devices that keep us connected. It is a broad field encompassing a range of sub-disciplines, including power generation and distribution, electronics, telecommunications, and control systems.

## Also: The best AI chatbots

As society becomes more interconnected and energy-conscious, the role of electrical engineering is increasingly vital, and key challenges, such as renewable energy integration, data security, and automation, require innovative solutions. Generative AI and ML offer groundbreaking approaches for automating circuit design, optimising energy management, and enhancing signal-processing techniques. These approaches will enable electrical engineers to create more efficient, reliable, and sustainable systems, which can shape a brighter future for us all.

## Powering everything:

- **Circuit design:** Platforms like [Cadence](#) and open-source tools like [KiCad](#) can automate and optimise electrical circuit design, saving time and effort.
- **Energy management:** Solutions such as [Verdigris](#) for smart-building design and open-source platforms like [OpenEnergyMonitor](#), and the various projects for energy providers hosted at [LF Energy](#), can optimise energy generation and consumption, contributing to sustainability.
- **Signal processing:** Commercial software such as [MATLAB](#) and open-source alternatives like [GNU Radio](#) can enhance signal-processing techniques, improving communication systems.

## How can generative AI and ML be used in chemical engineering?

Chemical engineering plays a pivotal role in many industries, from pharmaceuticals and petrochemicals to food processing and materials science, involving the application of chemical, physical, and biological processes to convert raw materials into valuable products. Chemical engineers optimize manufacturing processes, develop sustainable energy solutions, and ensure product quality and safety.

### **Also: These are my 5 favorite AI tools for work**

As industries strive for greater efficiency, reduced environmental impact, and enhanced innovation, chemical engineering becomes increasingly crucial, demanding constant innovation to meet evolving consumer needs and regulatory standards. Generative AI offers chemical engineers unparalleled process optimization, material synthesis, and quality control capabilities, allowing them to achieve unprecedented efficiency and precision, driving the industry into a new era of sustainable and high-quality production.

### **Transforming raw materials:**

- **Process optimization:** Commercial technologies like [AspenTech](#) and open-source platforms like [COCO Simulator](#) can optimize chemical manufacturing processes.
- **Material synthesis:** Commercial SaaS solutions such as [Citrine Informatics](#) and open-source tools like [Avogadro](#) can

assist in discovering new materials.

- **Quality control:** Companies such as [Lighthouse](#), tools like Advantive [InfinityQS](#), and open-source data science solutions like [KNIME](#) can be used to predict product quality in real time.

## How can generative AI and ML be used in biomedical engineering?

Biomedical engineering is a unique interdisciplinary field that merges engineering principles with the complexities of biology and medicine, aiming to enhance health care by developing technologies that improve medical diagnosis, treatment, and patient care. From designing state-of-the-art medical devices like MRI machines and prosthetic limbs to developing cutting-edge techniques for tissue engineering and drug delivery, biomedical engineers are at the forefront of medical innovation.

As the health care sector faces contemporary challenges, such as an aging global population, escalating healthcare expenses, and the growing demand for personalized medical treatments, Generative AI can be a highly transformative technology for pharmaceutical development and healthcare, offering unparalleled opportunities for accelerating drug discovery, customizing prosthetic designs, and enhancing medical imaging.

### **Bridging medicine and technology:**

- **Drug discovery:** Commercial technologies like [Atomwise](#) and open-source platforms like [RDKit](#) for Cheminformatics can accelerate drug discovery by predicting molecular properties. Microsoft's recently open sourced [EvoDiff](#) can be used to discover protein sequences for new drugs and therapeutics.
- **Prosthetics design:** Commercial tools like 3D Systems' [Medical Modeling](#) and open-source solutions such as [Open Bionics](#) can design customized prosthetics and implants.
- **Medical imaging:** Commercial platforms such as [Nanox AI](#) and open-source tools like [ITK Insight Toolkit](#) can enhance medical image quality, aiding more accurate diagnoses.

## **How can generative AI and ML be used in aerospace engineering?**

Aerospace engineering is a specialized field that focuses on developing and designing aircraft, spacecraft, and related systems and equipment. Aerospace engineers design commercial airliners, drones, satellites, launch vehicles, space capsules, and space habitats, working on complex challenges, including aerodynamics, propulsion systems, structural design, and navigation. They aim to push the boundaries of what is possible in air and space travel.

**Also: [ChatGPT and the new AI are wreaking havoc on cybersecurity in exciting and frightening ways](#)**

As humankind sets its sights on achieving lofty goals, such as space tourism and interplanetary colonization, the role of aerospace engineering becomes increasingly pivotal. The field, once only the domain for government agencies with megabudgets, is ripe for innovation, especially as it grapples with fuel efficiency, safety, and environmental sustainability issues. Generative AI offers novel solutions for optimizing aircraft designs, enhancing navigation systems, and improving fuel consumption.

## **Reaching for the skies:**

- **Aircraft design:** [Siemens' NX](#) and open-source platforms like [OpenVSP](#) can optimize aircraft component designs for weight, strength, and aerodynamics.
- **Navigation systems:** Defense industry solutions from [Northrop Grumman](#) and open-source tools, such as [ArduPilot](#) and [Dronecode](#), can enhance navigation and control systems.
- **Fuel efficiency:** Honeywell's [Forge](#) and open-source solutions like [JSBSim](#) can optimize fuel consumption, contributing to sustainability.

**How can generative AI and ML be used in environmental engineering?**

Environmental engineering is a critical discipline that focuses on protecting and improving the natural environment for human health and ecological well-being. Environmental engineering encompasses a wide range of activities, from water treatment and waste management to air-quality control and renewable energy solutions.

**Also: Train AI models with your own data to mitigate risks**

With pressing challenges, such as climate change, pollution, and resource depletion, the role of environmental engineering becomes increasingly vital, requiring innovative solutions to complex problems, and often involving interdisciplinary collaboration between scientists, policymakers, and community stakeholders. Generative AI is emerging as a powerful tool in this arena, offering cutting-edge solutions for optimizing waste management, modeling climate impacts, and efficiently utilizing natural resources, so engineers can develop more effective and sustainable strategies to safeguard our planet for future generations.

**Saving the planet:**

- **Waste management:** Commercial platforms like Rubicon can optimize waste collection and recycling processes.
- **Climate modeling:** The Community Earth System Model and open-source platforms like OS-Climate and OpenFOAM can model climate impacts.

- **Resource optimization:** Open source map-data solutions, such as Overture Maps Foundation and OpenStreetMap, can be used to optimize natural resources.

**Conclusion**

Generative AI and machine learning are more than just technological advancements -- they are driving changes in tooling, processes, and methodologies that are revolutionizing the engineering landscape. The unique ability of these technologies to optimize and accelerate processes across various engineering disciplines makes them indispensable for modern engineering disciplines. As such, the message for businesses and engineering leaders is clear: embrace generative AI to stay competitive and future-ready.

## Exploring AGI and Generative AI, the AI Prodigies

It's a brave new world where AI not only stands for "Artificial Intelligence" but also "Absolutely Ingenious."

*The extraordinary notion of machines exhibiting human-like thinking and creative abilities—this is something that has intrigued and fascinated us for years. If machines could write their own code, design their own products, or discover their own science. If they could do anything that we can do, and maybe even more? Well, that's the ultimate goal of artificial intelligence (AI), which is the technology that makes machines smarter and faster.*

But not all AI is the same. There are different types and levels of AI, and two of the most fascinating and challenging ones are **artificial general intelligence (AGI)** and **generative AI**.

*AGI is a type of AI that can perform any task that a human can. AGI is not limited by specific domains or skills, but can learn and adapt to any situation.*

*Generative AI is a type of AI that can create new and original content, such as images, text, music, or code. Generative AI models learn from a lot of data and then use their knowledge to produce new outputs that are relevant and realistic.*

### Generative AI = Innovation

Generative AI opens up a whole new realm of possibilities in content creation. It's like having a never-ending well of creative inspiration, where the boundaries of imagination are constantly pushed and new frontiers are explored.

The power of generative AI lies in its ability to generate original content that surprises, delights, and challenges our preconceived notions of what is possible. It's a game-changer that sparks innovation and propels us into uncharted territories of creativity.

Generative AI is like having a team of brilliant artists, musicians, and writers working tirelessly behind the scenes. It's as if you have a group of Picasso, Mozart, and Shakespeare rolled into one powerful machine. Just feed it some data, and it will unleash its creative prowess to generate stunning images, mesmerising melodies, or captivating stories.

### AGI = Versatility

AGI, or Artificial General Intelligence, is like the ultimate multitasker of the AI world. It aspires to create machines that are not confined to specific tasks or domains but can adapt and excel in a wide range of intellectual challenges, just like humans do.

Think about how versatile we humans are. We can switch gears effortlessly from solving math problems to engaging in philosophical discussions or even cooking up a delicious meal. AGI aims to capture that versatility by developing machines that can handle diverse tasks and domains with ease.

These AGI systems are designed to be lifelong learners, constantly acquiring new knowledge and skills. They can reason, understand complex concepts, and apply their understanding to different contexts. It's like having an AI companion that can effortlessly navigate through various domains, problem-solving like a pro, and making informed decisions.

The beauty of AGI lies in its adaptability. It's not a one-trick pony. It can tackle everything from medical diagnosis to scientific research, from playing chess to composing music. AGI systems can learn from their experiences and continuously improve their performance, just like we humans do through practice and exposure to new challenges.

## **The Synergy**

When AGI and Generative AI join forces, their collaboration becomes even more remarkable. AGI's adaptability enhances the creative capabilities of Generative AI, enabling machines to generate content that goes beyond existing boundaries. It can assist in refining and improving the outputs of Generative AI, resulting in even more impressive and imaginative creations.

### **1. Collaborative Content Creation**

AGI and Generative AI make an unstoppable duo when it comes to content creation. Think of AGI as the creative consultant, diving into the depths of art, music, and storytelling knowledge. It shares its expert insights, and Generative AI takes those nuggets of inspiration and works its magic, generating captivating visuals, catchy tunes, and engaging narratives. Together, they create content that's out of this world, blending human ingenuity with AI wizardry for an extraordinary creative partnership.

### **2. Personalised Learning and Education**

AGI understands students' learning needs and collaborates with Generative AI. They create interactive simulations, adaptive quizzes, and

tailored learning materials for personalised education, enhancing effectiveness and catering to diverse needs.

### **3. Scientific Discovery and Research**

AGI assists scientific research by analyzing data and identifying hidden patterns. Collaborating with Generative AI, they generate hypotheses, simulate experiments, and create visual representations. This accelerates discovery in fields like medicine, physics, and climate science.

### **4. Creative Tools and Design Assistance**

AGI acts as a versatile creative assistant, supporting artists and designers. It understands objectives and provides insights, suggestions, and alternative design options. Generative AI generates visuals and prototypes based on AGI's guidance, streamlining the creative process.

### **5. Decision Support Systems**

AGI's adaptability and reasoning, combined with Generative AI's scenario generation, support decision-making. AGI analyzes data, providing comprehensive insights, while Generative AI generates simulations exploring different outcomes. This aids informed decisions in business, policy, and research.

## **AGI and Generative AI as Catalysts for Positive Change**

From curing diseases to addressing global warming, exciting advancements are in store for us in the future as AGI and Generative AI continue to evolve. The potential impact of these technologies

reaches far and wide, offering solutions to some of the most pressing challenges we face as a society.

In the field of healthcare, AGI and Generative AI can revolutionise diagnostics, treatment, and drug discovery. By analysing vast amounts of medical data, they can identify patterns and correlations that may lead to breakthroughs in disease prevention and personalised medicine. This could mean earlier detection of diseases, more precise treatments, and ultimately, improved patient outcomes.

When it comes to environmental concerns, AGI and Generative AI can play a significant role in addressing global warming and promoting sustainable practices. These technologies can analyse environmental data, model climate change scenarios, and generate innovative solutions for reducing carbon emissions, optimising energy consumption, and managing scarce resources. With their help, we can work towards a greener and more sustainable future.

*The possibilities truly are endless when it comes to the transformative impact of AGI and Generative AI. As these technologies continue to advance, we can envision a future where they are applied to a wide range of pressing challenges and finding effective solutions.*

## **The ABCs of AI: A beginner's guide to the fundamentals - Machine learning, neural networks, and deep learning.**

Curious about Artificial Intelligence but feel like it's a daunting and complex topic? Fear not, because today we're going to break it down and cover the basics of AI in a way that's easy to understand.

AI is a fascinating and rapidly developing field that has the potential to revolutionise the way we live and work. From autonomous vehicles to virtual assistants, AI is already changing the world around us, and it's only going to become more prevalent in the years to come. But if you're just getting started with AI, it can be tough to know where to begin. That's why I am here to help you understand the basics of AI, including machine learning, neural networks, and deep learning, without the technical jargons and complex concepts.

### **So, what is AI?**

**In a nutshell, it's the development of computer systems that can perform tasks that would typically require human intelligence, such as recognising speech, interpreting data, or even playing games. Pretty cool, huh?**

And the possibilities are truly endless. From helping doctors diagnose diseases to improving traffic flow in cities, AI has the potential to transform every aspect of our lives.

AI is already being integrated into many aspects of our daily lives, even if we don't always realise it. For example, have you ever used a virtual assistant like Siri or Alexa to set a reminder or answer a question? That's AI in action.

Another common example is the use of AI in **recommendation systems**, such as those used by Netflix or Amazon. These systems analyse your past behaviour and preferences to suggest movies, shows,



or products that you might like. This not only improves your user experience but also helps companies to better understand and cater to their customers' needs.

## **Now, let's talk about Machine Learning**

This is a subset of AI that involves giving computers the ability to learn and improve from experience, without being explicitly programmed. Think of it as teaching a computer how to learn on its own. Machine learning can be used for a variety of tasks, such as detecting fraud, predicting customer behaviour, or even diagnosing medical conditions.

So, how does machine learning work? It's all about algorithms — mathematical formulas that enable the computer to analyze data, identify patterns, and make decisions based on those patterns. The more data that the computer is fed, the more accurate its predictions become. One example of machine learning in action is **image recognition**.

Say you wanted to teach a computer to recognise cats. You would start by feeding the computer thousands of images of cats and labelling them as such. The computer would then analyse those images and look for patterns — such as the shape of a cat's ears or the position of its eyes.

Over time, the computer would become better and better at recognising cats, even when presented with new images it hasn't seen before.

Another example is natural language processing, which involves teaching computers to understand and respond to human language. By analysing large amounts of text data, computers can learn to recognise

speech patterns and even understand the meaning behind words and phrases.

## **Neural Networks are another important aspect of AI**

Neural networks are like a bunch of puzzle pieces that fit together to help computers make sense of information. Just like our brain's neurones process information, these interconnected nodes can help computers learn to recognise patterns and understand speech.

For example, they can be used to detect objects in images, like your phone's camera recognising your face or your pet's face. They can also be used to power voice assistants, like Siri and Alexa, to help them understand what we're saying and respond accordingly.

Think about it — when you say “Hey Siri, play some music”, she uses neural networks to understand what you're asking for and then pulls up a playlist of your favourite tunes.

The best part about neural networks is that they can improve over time, just like how we get better at something the more we practice it. This means that they can learn and adapt as they're exposed to more data, making them even more accurate and useful for a variety of tasks.

## **Finally, let's talk about Deep Learning**

Deep learning is like a brain within a brain — it's a type of machine learning that uses advanced neural networks with multiple layers to analyse complex data. These complex networks can find patterns and relationships that would be impossible for a human to detect on their own.

This is what makes deep learning so powerful and useful in a wide range of applications, from detecting fraud to improving healthcare. It's like having a supercharged AI brain on your team!

Deep learning is still like a curious child that loves to explore and discover new things. Even though we've made great progress in this field, there's always more to learn and new techniques to develop. Researchers are constantly working to make deep learning models even better and more powerful, like adding new superpowers to a superhero! So, we can expect more exciting breakthroughs in the future!

At its core, AI is simply about teaching computers to learn and make decisions on their own. As we continue to develop this technology, it has the potential to improve our lives in countless ways, from helping us stay healthy to making our daily routines more efficient.

But as exciting as these advancements are, it's also important to remember that AI is ultimately a tool that we control, not the other way around. As we explore the possibilities of this technology, we must also consider the ethical implications and ensure that it is being used in ways that benefit society as a whole.

At the end of the day, AI is not just about machines and algorithms — it's about using technology to make a positive impact on the world around us. And as long as we keep that in mind, there's no telling what we can achieve.

## **Adopting AI will make engineering firms more knowledgeable, efficient and profitable**

**03 NOV, 2023 BY**

With an impressive surge in advancement over the past 18 months, the artificial intelligence (AI) market is on track to reach a staggering £9.87bn by the end of this year, with an expected growth rate of 15.17% between 2023 and 2030.

Bret Tushaus is VP of Product Management at Deltek

Given the speed at which AI is progressing, it's not surprising that this technology is leaving its mark on the world of architecture and engineering (A&E). The introduction of AI in A&E is equipping firms with the tools they need to become more knowledgeable, efficient and, ultimately, more profitable.

However, for all the promise and excitement around AI, widespread adoption remains a significant challenge. Deltek's *Clarity: Trends and Insights for Architecture, Engineering and Consulting Firms* research finds that more than half (53%) of A&E firms report adopting AI is a top challenge for their business. This is a result of businesses grappling with many issues associated with navigating this new, fast-moving technology, such as data accessibility, limited employee awareness, and the complexities of implementation.

Nonetheless, overcoming these AI adoption challenges should be a top priority. Leveraging AI to streamline the project management lifecycle early on and integrating it into business operations could give firms a significant jump on their competitors.

At Deltek, discovering new ways businesses can benefit from leveraging AI technology is key to keeping our solutions relevant and adding value to our customers.

## **How AI is transforming Deltek project nation**

41% of architecture and engineering firms recognise AI as being very important to their business, holding the potential to streamline content creation, facilitate decision-making, and even prescribe and automate action. Following 2023's economic and workforce challenges, the rise of AI couldn't have come at a better time for the project landscape.

AI has the capability to increase project efficiencies by empowering strategic decision-making through analysing historical performance and data inputs. For example, if an A&E firm consolidates all its data within one platform, AI has the capability to predict the probability of winning a potential project, run a report on a project's progress in seconds and make predictions about the future of the project. These insights, which traditionally take hours to collate, empower organisations to distribute resources, understand where investments are best made and focus efforts with greater precision and effectiveness.

## **Using AI to tackle A&E challenges**

The same Deltek research found that admin workload is a top challenge for more than a third (37%) of A&E companies, with managing project-related emails a hurdle for over one in three (36%). On a day-to-day basis, admin-related challenges are almost always more time consuming than predicted. It is these moments that hit productivity most. What can be perceived as a simple task – for

example, responding to client emails – in reality takes up 25% of our day. For project-based business, this time waste has a huge impact on the business' bottom line.

The integration of AI can ease these pressures through automation, allowing project managers to dedicate more time to the human aspect of their projects. While the human-touch is always going to be needed with clients, AI holds the potential to streamline and automate admin workload. Rather than spending hours collating a report for a client each week, AI has the capability to instantly collate all the required insights in moments whenever needed. For example, rather than spending hours bringing another member of the team up to speed on a project, AI can instantly pull together an introduction – including all the vital information. Taking responsibility for admin-heavy tasks, AI enables project managers to focus on the areas of business where humans add the most value. For example, building relationships, exploring new business opportunities, and handling critical situations.

Through these simple efficiencies, AI possesses the potential to elevate project performance metrics by forecasting project outcomes based on current trajectory and historical data.

## **AI's power being embraced by A&E firms**

When integrating AI into A&E firms, it's worth remembering this technology is still relatively new, which means it comes with some challenges. Successful adoption will come from A&E companies embracing adaptability and resilience in the face of the unknown, or yet-to-be-tested. By strategically investing in state-of-the-art

technology – through partner integrations or seamless integration within the business – organisations can demonstrate their commitment to enhancing efficiency and productivity.

The rapid advancement of AI has introduced a learning curve for all businesses. Ensuring decision makers stay at the forefront of industry trends is essential to determining which technologies will and won't be useful to their organisation.

For many organisations, the question comes down to what next and how to begin. The key is being on the journey and pinpointing the most significant benefits. This comprehensive approach fosters success, resilience, and competitiveness in a business landscape that is evolving at a rapid pace.

The A&E industry stands at the brink of an extraordinary era driven by AI. Companies that embrace its transformative potential will thrive in an increasingly competitive environment. The path forward is crystal clear: seize the opportunities around AI, embrace streamlined business processes and empower project managers with essential business information in moments, rather than hours. By doing so, project-based businesses will continue to progress, adapt, and flourish in the era of artificial intelligence.

July 12, 2023

## **Open Immersive Reader**

Artificial intelligence (AI) has been a topic of fascination and speculation in the world of science fiction for decades. From the early days of computing, researchers and thinkers have been captivated by

the idea of creating machines that can replicate human intelligence. While the complexity of the human brain surpasses the capabilities of current computers, AI has still made significant advancements and is now playing a prominent role in various industries.

## **Understanding Artificial Intelligence**

Artificial intelligence refers to the development of computer systems that can perform tasks that typically require human intelligence. It encompasses a wide range of technologies and techniques, including machine learning, natural language processing, computer vision, and robotics. AI systems are designed to analyse large amounts of data, recognise patterns, and make decisions or predictions based on that information.

The concept of AI was first introduced in 1956 at a meeting held at Dartmouth College. Since then, AI has evolved significantly, with advancements in computing power, algorithms, and data availability driving its growth. Today, AI is used in numerous applications, from voice assistants on smartphones to complex industrial processes.

## **The Growing Presence of AI in Engineering**

The engineering profession is not immune to the influence of AI. In fact, AI is revolutionising the field, opening up new possibilities and transforming traditional practices. Here are some key ways in which AI is impacting the engineering profession:

### **I. Design and Optimisation**

AI is increasingly being used in the design and optimisation of engineering systems. By analysing vast amounts of data on performance, efficiency, and other factors, AI algorithms can identify optimal designs for complex systems such as aircraft, automobiles, and manufacturing processes. This not only leads to more efficient and effective engineering designs but also enhances industries like transportation and manufacturing.

## 2. Automation of Engineering Tasks

AI is playing a crucial role in automating various engineering tasks. By analysing data from sensors and other sources, AI algorithms can identify potential issues with engineering systems and provide recommendations for resolution. This reduces the need for human intervention in maintenance and operation, improving efficiency and minimising errors. Engineers can focus on value-adding activities while AI handles repetitive and mundane tasks

## 3. Simulation and Analysis

AI is also enhancing the accuracy and speed of engineering simulations and analyses. Machine learning algorithms can analyse simulation data and identify patterns or trends that might be difficult for humans to detect. This enables engineers to make more informed decisions and optimise designs more effectively. AI-driven simulations can provide valuable insights into system behaviour, helping engineers develop robust and efficient solutions.

## 4. Expertise Augmentation

AI is augmenting the expertise of engineers by providing them with powerful tools and resources. AI algorithms can assist engineers in complex problem-solving, providing insights and suggestions based on extensive data analysis. This collaboration between humans and AI systems amplifies engineering capabilities, leading to innovative solutions and improved efficiency.

## 5. Predictive Maintenance and Fault Detection

AI is transforming maintenance practices in engineering. By analysing sensor data and historical performance data, AI algorithms can predict when equipment is likely to fail and recommend maintenance actions to prevent costly breakdowns. This proactive approach to maintenance reduces downtime, increases equipment lifespan, and improves overall operational efficiency

## 6. Robotics and Automation

AI-driven robotics and automation are revolutionising the manufacturing and industrial sectors. Robots equipped with AI capabilities can perform intricate tasks with precision and efficiency. They can handle complex assembly processes, optimise production flow, and improve overall productivity. The integration of AI and robotics is reshaping how engineers approach manufacturing and is leading to the development of more advanced and flexible production systems.

## 7. Energy Optimisation

AI is also being used to optimise energy consumption in engineering systems. By analysing data on energy usage patterns, AI algorithms can

identify opportunities for energy efficiency improvements, reducing costs and environmental impact. This is particularly relevant in sectors such as building management, where AI-driven systems can optimise heating, cooling, and lighting to achieve maximum energy efficiency.

## 8. Safety and Risk Management

AI has the potential to enhance safety and risk management in engineering operations. By analysing historical data and real-time sensor data, AI algorithms can identify potential safety hazards and predict risks. This enables engineers to take proactive measures to mitigate risks and maintain a safe working environment. AI-driven systems can also help in emergency response planning by simulating different scenarios and providing insights into the best course of action.

## 9. Enhanced Collaboration and Communication

AI technologies are improving collaboration and communication among engineering teams. AI-powered tools enable engineers to share and access information more efficiently, facilitating collaboration across geographically dispersed teams. Natural language processing capabilities make it easier to extract relevant information from vast amounts of data, enabling engineers to make informed decisions quickly.

## 10. Ethical Considerations

While AI brings numerous benefits to the engineering profession, it also raises ethical considerations. As AI becomes more prevalent, engineers need to ensure that AI systems are designed and used responsibly. This includes addressing issues such as bias in AI algorithms,

ensuring transparency and accountability, and considering the potential social and economic impacts of AI implementation.

## The Future of AI in Engineering

The impact of AI on the engineering profession will continue to grow in the coming years. As AI technologies advance and become more sophisticated, engineers will need to adapt and acquire new skills to leverage the full potential of AI. The ability to understand, develop, and integrate AI systems will be a valuable asset for engineers.

Moreover, the collaboration between humans and AI systems will become increasingly important. Engineers will need to work alongside AI technologies and leverage their capabilities to drive innovation and solve complex engineering challenges. This partnership between human expertise and AI capabilities will lead to groundbreaking advancements in various fields of engineering.

Artificial Intelligence is reshaping the engineering profession, unlocking new possibilities, and transforming traditional practices. From design optimisation to automation, AI is revolutionising how engineers approach their work. Embracing AI technologies and developing the necessary skills will be crucial for engineers to thrive in the rapidly evolving engineering landscape.

-



**By: Doug Dockery, Chief Technology Officer on February 21st, 2023**

## **AI in Construction Has Landed**

This article provides a foundational understanding of artificial intelligence in preconstruction. We'll explore how AI offers ways to enhance the processes that drive business for better decision-making and strategic preconstruction planning.

### **What is Artificial Intelligence?**

The data-rich, complex modern construction environment offers a potential advantage to those businesses that can harness data, produce intelligible insights, and make informed strategic decisions. AI is establishing a footing in the construction industry following years of development and imagination.

AI is here now because of advances in computing power, algorithms that follow precise steps, the large sets of data the industry produces, and innovations in the systems that combine these advances. The time to understand and integrate AI into your business is now.

Artificial intelligence is not a new idea, its roots can be traced back to the 1950s. Arthur Samuel, a pioneer in the field, defined it as “the field of study that gives computers the ability to learn without explicitly being programmed.” In other words, AI involves computers and systems that learn from experience. The purpose of AI is to make machines do things that humans are presently doing, but do them better and faster.

### **Artificial Intelligence, Machine Learning, and Deep Learning**

**Artificial intelligence** is a field in data science that blends computer technology with hefty amounts of data to enable problem-

solving. You may have experienced AI in a voice search with Amazon's Alexa or Apple's Siri. Search engines also power results with AI to collect and retrieve relevant information based on user inquiries. Videos suggested to you by YouTube or Netflix are AI-driven results that recommend titles based on learning your preferences and viewing habits.

You may hear machine learning mentioned in the same breath as artificial intelligence, but the terms are not entirely interchangeable. **Machine learning** is a subset of artificial intelligence that learns from experience, adapts, and improves performance without being explicitly programmed.

A third part of artificial intelligence getting a lot of exposure today is **deep learning**. All AI aims to mimic human thinking, and deep learning is designed to extract maximum value from our way of processing information. Our brains use what scientists call neural networks, which are the collection of brain cells that help us process information by connecting signals. Deep learning uses **artificial neural networks** to process large amounts of data and solve problems with limited human help. These artificial intelligence networks are valued for their ability to handle lots of data, continue to improve as it trains and learns, and solve complex issues.

## Artificial Intelligence in Preconstruction

Before building starts on a commercial construction project, a variety of people and teams from different disciplines and expertise must collaborate and plan how the project will proceed. Preconstruction, as it's called, refers to the phases of construction that take place before

the actual construction work begins. Building owners, architects and engineers, trade contractors, general contractors, building product manufacturers, and many others take part in preconstruction.

The preconstruction process in commercial construction helps to ensure that the project is completed on time, within budget, and to the client's satisfaction by identifying and addressing the sequence of people and events that will get the project completed.

Just like the projects being built, solid foundational work in preconstruction carries over greatly into the strength of the project. Variations in preconstruction stages occur depending on variables such as the type of structure or project (e.g., hotel, school, road, or bridge), project delivery methods, the scope of work involved, or if it is a public or private construction project.

## AI In Preconstruction Project Stages

The following preconstruction project stages provide a framework for the steps before construction starts and how artificial intelligence is changing how this planning is performed.

**Pre-Design:** This phase includes the conceptual design, initial project planning, project development, and feasibility studies. The project team typically begins with the concept of the structure, performs a site analysis to identify potential obstacles, and develops a plan to address them. This phase also includes the development of a rough or working project scope and budget.

AI in the pre-design or initial project planning and development phase is helpful for feasibility studies to determine if a project is viable. Risks



can be identified and analysed with various data, including financial data, market data, and data on the project's potential impact on the environment. Risk analysis can assist in deciding whether to proceed with the project. AI is a powerful tool at this stage because it offers thoroughness and accuracy, along with a general lack of bias.

**Design Development:** This phase includes the development of detailed design documents that steer the project. Documents included in this stage include architectural, structural, mechanical, electrical, and plumbing plans.

Design development is a critical phase in the project development process. It involves taking the conceptual design and turning it into a more detailed and buildable design, moving from general ideas to more specific ones. The design development phase is where many important decisions are made that will shape the final project, including cost, energy efficiency, and overall functionality. Artificial Intelligence can play a significant role in this phase by providing new tools and techniques to improve the efficiency and quality of the design development process.

**Construction Documents:** This phase includes the development of final construction documents, including detailed construction plans, building product specifications, and contract documents. The finalisation of the construction schedule is prepared, which outlines the sequence and expected duration of all activities required to complete the project.

AI-based tools can be used to automate the process of extracting, analysing, and processing data from construction documents. For example, natural language processing (NLP) can be used to analyse

project requirements and create a detailed project scope document based on two-dimensional construction plans like PDF files. NLP has been around for over a half-century and is the component of AI that understands and interprets human language, written and spoken. This can save time and resources compared to the tedium of traditional methods, such as manual data entry or spreadsheet calculations.

**Bidding and Negotiation:** This phase includes distributing the plans to trades, contractors, and manufacturers for bidding. The project team will review the bids, negotiate with contractors, and select winning bids. For general contractors and trade contractors, this is the essential phase that includes producing and delivering detailed takeoffs and estimates to submit a competitive bid.

Trade contractors, general contractors, and building supply manufacturers assess the project scope, identify opportunities to pursue, analyse bidding strategies, and decide which projects clear the hurdle for success. Trade contractors can use the power of AI to streamline processes, automate repetitive tasks like takeoffs, and improve the speed at which decisions like vetting profitable projects are made.

**Permitting and Approvals:** This phase includes the submission of the construction documents to the appropriate governmental agencies, where appropriate, for review and approval. Artificial intelligence is used in this phase to validate building code compliance and manage the building permit process.

**Finalise Preconstruction:** This phase includes finalising contracts, mobilisation of the contractors, and the start of construction

activities. Effective preconstruction planning and strategic decision-making are key components of profitability for trades, general contractors, and building product manufacturers.

The finalisation of the construction schedule is prepared, which outlines the sequence and expected duration of all activities required to complete the project.

The preconstruction stages can become more complex due to the nature of the project, the inherent need for effective communication and collaboration among teams, and local and national regulations, among others. Time and budget issues are consistently make-or-break drivers of a profitable construction project. Technology like AI offers an opportunity to improve performance throughout the preconstruction lifecycle.

## Where Else AI and Construction Are Teaming Up

Aside from preconstruction, AI is a technology continuing to emerge in other areas of construction, enabling improvements in performance and safety. Some examples include:

**Predictive maintenance:** AI can be used to analyze data from building systems, such as HVAC and electrical systems, to predict when maintenance will be needed and prevent equipment failure

**Site safety:** AI-powered cameras and sensors (even some worn by workers) can monitor construction sites for potential safety hazards and alert workers and managers to potential dangers.

**Robotics:** The efficiency of AI and machine learning have found their way into robotic bricklaying, welding, and even building entire structures with 3D printing.

**Project management:** AI can optimise the allocation of labor and materials, making the scheduling of construction tasks more efficient and cost-effective.

**Quality control:** AI-powered cameras and sensors can monitor the quality of construction work, identify defects, and alert workers and managers to issues that need to be addressed.

**Building performance:** AI could be used to analyse data from building systems to optimise energy efficiency, indoor air quality, and other performance metrics. Simulating building efficiency with AI, for instance, allows the identification of potential energy-depriving areas for better design and construction.

## The Knowledge and Insight Enhancer

It is common to hear that computers trained to think like humans are a threat to stealing jobs from people. But construction is inherently reliant on the vast institutional and individual knowledge, something that AI cannot replace. Where human judgment is involved, and we know that's everywhere throughout the construction project lifecycle, AI does not have the capability we humans do.

It's more likely that certain roles and responsibilities will change as AI is implemented. AI combined with a company's organisational knowledge will offer much greater strategic opportunities than those

not adopting the technologies to streamline performance and make better data-driven decisions.

## **Bright Future for AI in Construction**

The present and future of AI in the construction industry are promising as more AI-based tools and techniques become integrated into workflows. As technology advances, AI is expected to become an even more integral part of the construction process, helping to improve efficiency, reduce costs, and enhance construction performance outcomes. AI in the construction industry has landed. Get ready for it.

## **How Generative AI Can Improve Discrete Manufacturing Profitability**

As generative AI continues to rise in popularity, we are seeing an exciting shift in the overall artificial intelligence paradigm. For the first time in history, powerful AI tools are now directly available to a much wider audience than ever before.

We have already seen a variety of AI applications introduced into a broad range of industries. Some of these solutions have been straightforward, while others are pretty sophisticated. However, as we turn our attention to the industrial space, the question arises: Can generative AI also help solve problems faced by manufacturing companies?

Research shows that **88%** of manufacturers are still facing long lead times from suppliers, most of which are rooted in the challenges brought on by the Covid-19 pandemic. Because of this prolonged

struggle, **71%** of companies around the world cite raw material costs as their top supply chain issue for 2023.

When this is added to the fact that material costs account for an average of **42%** of the entire manufacturing industry cost structure, it is clear that the sector as a whole desperately needs a way to increase efficiency and tool handling to boost outputs and reduce lead times.

In light of this, I believe it is time to turn to generative AI for potential solutions.

## **Levelling The Playing Field For Small And Medium Manufacturers**

The first way that generative AI is improving discrete manufacturing profitability is through the democratisation of artificial intelligence and data science tools. Some of the most recent developments, such as OpenAI's ChatGPT code interpreter plug-in, offer smaller industrial companies access to valuable data insights.

Before, this type of data analysis and value extraction would require a team of expert data scientists and months or years of fleshing out an entire, complex data infrastructure before anything useful could be done. This is not only an unfeasible upfront cost but a massive bet on the strategy's long-term usefulness and profitability. For smaller enterprises without the financial cushion to support this, most manufacturers choose to stick with older, tested business models because it is all they can afford.

With the advent of widely available generative AI tools, affordability is suddenly a much less pressing issue. Now, advanced data collection,

collation and analysis can be completed by a single, relatively inexpensive tool and reviewed by a single expert or small team of experts. This drastically lowers the barriers to entry and allows for a more innovative, competitive and agile manufacturing market.

The important takeaway is that to benefit from this AI-powered profitability strategy, small and medium manufacturers must take the initial leap of faith by implementing the right technologies to at least begin collecting data from their factory floors. Without this data set, even the best AI tools will be useless.

## **Three Simple Ways AI Can Boost Manufacturing Profitability**

### **1. Improving And Streamlining Existing Processes**

According to current research, [less than a quarter](#) of companies have taken significant strides toward digitalising their manufacturing processes. The few that have incorporated data collection or analytics are generally not leveraging this technology to their advantage.

This leaves the door wide open for manufacturers to implement AI tools on the factory floor that can provide invaluable data and insights regarding ways to trim down the high costs of traditional production and labor methods. Generative AI can collect and analyse machining data or existing instructions for parts production and propose changes that boost efficiency, reduce waste and substantially lower rejection rates, all of which are common manufacturing bottlenecks.

### **2. Monitoring Machining Tool Quality**

The average manufacturer's bottom line includes [800 hours of downtime](#), causing millions in lost revenues, higher labor costs, missed deadlines and damaged business relationships. Even planned downtime affects overall outputs, so streamlining planned stops and minimising unplanned incidents is AI's goal.

Generative AI's greatest strength is interpreting data and finding improvements faster than humans. In manufacturing, this means lowering spending on emergency tool repairs and improving a machine's life span through predictive maintenance. With these advantages, unexpected failures are drastically reduced, throughput quality stays consistent and companies can more accurately budget for replacements and maintenance.

### **3. Optimising Forecasts With Advanced Data Analysis**

The ongoing raw materials shortage and general supply chain issues mean manufacturers must use every available tool to reduce delays and interruptions. Implementing generative AI can help industrial businesses optimise raw materials spending and boost supply chain efficiency through advanced data analysis.

Beyond this, AI can potentially provide more detailed supply and demand forecasting by parsing external market data and past and present forecasts, helping manufacturers optimise inventory levels and smooth their supply chains.

## **Potential Challenges Of GenAI In The Manufacturing Sector**

While generative AI has enormous potential to change the manufacturing landscape, it's important to acknowledge its limitations.

First, there are still plenty of unknowns because the technology is new. We know it works well with text and information, but there isn't as much real-world evidence yet to support it working as seamlessly with industrial equipment data. There will inevitably be challenges as this process is implemented and refined over time.

In addition, there is still a serious lack of user trust within the sector. Factories are already operating with razor-thin margins for errors and problems, so they are wary of adding anything new that might cause problems during the initial implementation. Seasoned professionals will require some convincing to make such a big technological leap because they are used to the way things currently are, even though these processes are quite outdated.

## **Harnessing The Power Of Generative AI With Data Collection Integrations**

Before any manufacturer can take advantage of these robust AI use cases, the first step is upgrading the factory floor with the ability to collect machine data. Without this foundation, generative AI will pass your company by, and competitors will have the advantage.

By taking a small leap of faith into the digital future, the industrial manufacturing sphere can overcome the challenges of supply chain disruptions, downtime and the inefficiencies of outdated production processes with the help of generative AI.

[Forbes Technology Council](#) is an invitation-only community for world-class CIOs,

## CONTENT

The Questions

Fortunately, It's Only Science Fiction...

The Rise of Artificial Intelligence in Engineering

AI Applications in the Engineering Field

Summary: Why AI Won't Replace Engineers

## Resources

Will AI replace engineers?

**THE LIGHT SIDE VISION.** According to the World Economic Forum Jobs of Tomorrow article, engineering skills are one of the highest-demand skills. Indeed, engineering has always been considered an evolving industry. The rapid advancements of AI technology and related jobs, such as machine learning (ML), enable engineers to complete their work in a more efficient way and solve a wider range of problems, empowering their expertise and making them the main

SORT CODE : Eng NZ - AI ADVISORY GROUP

actors of the industry's future development and success, thus creating a growing need for their profession.

**THE DARK SIDE VISION.** "AI and automation in engineering may cause job losses and economic inequalities. Engineers must be cautious when implementing AI to avoid negative consequences, such as losing insight into what is happening and eventually losing their jobs, despite the overall benefits."



Ned Ludd (a legendary person) in 1779 allegedly lead riots against the raising power of machines menacing jobs

## The Questions

Will AI replace engineers? What vision for our future is more probable? Should we believe the Dark Side or the Light Side stories?

We wonder what will happen next, whether jobs will decrease or increase. And will AI automate and destroy jobs, or automate and enhance them?

Should we follow the legendary Ned Ludd in a sort of "Butlerian Jihad" (see below), or stick to the point of the World Economic Forum and Prof. Klaus Schwab, talking of a golden age thanks to new approaches like Industry 4.0 and AI?

As AI tools are expanding, it seems that in the near future, data scientists, computer scientists, and other new jobs and profiles in AI technologies, such as DL (deep learning), will be the knowledge workers. However, in this article, we will show the application of AI tools for the product development process and that Artificial Intelligence (AI) is rather a help for critical thinking.

Will AI replace engineers? We feel the answer to this question is "no". The future is bright.

Follow us to know our arguments on AI technologies and their near future benefits. Rather than quoting market research analysts, we will give practical hands-on examples from the world of engineers.

By merging test data, simulation tools data, and technical drawings (CAD) data, data scientists and computer scientists are creating more opportunities and jobs for themselves but also for engineers involved in manufacturing processes and product development.

They do this by providing valuable data-driven AI insights to all engineers in the supply chain from concept to production.

Thus, the job market for engineers is going to shift from manual executions to more concept work, creating new jobs for humans in all industries rather than more power for an "evil AI".

The "Butlerian Jihad" is a fictional event in Frank Herbert's science fiction series "Dune". For those who watch movies and do not read books, it explains why in the recent "Dune" series, there are human computers or "Mentats" rather than artificial assistants. AI has been exterminated!

In the Dune Universe, the Butlerian Jihad was a human uprising against the dominance of thinking machines and artificial intelligence, sparked by fears of humans becoming overly reliant on technology to the point of losing control over their own destinies.

Similarly, the positive aspects of fully autonomous driving on the workforce that we will highlight later show the potential benefits of AI-driven automation in transportation.

However, just as the Butlerian Jihad was a response to unchecked AI dominance, the real-world adoption of autonomous driving technology necessitates careful consideration of potential drawbacks.

As the technology progresses, concerns arise about job displacement in the transportation industry, where autonomous vehicles could replace human drivers.

## Harnessing the Positive Potential of AI Tools

The fictional Butlerian Jihad caution us to approach the advancement of AI with foresight and ethical considerations, ensuring that it serves as a complement to human expertise rather than a wholesale replacement. This way, we can harness the positive potential of autonomous driving while safeguarding the interests and well-being of the American workforce.

## The Rise of Artificial Intelligence in Engineering

The use of artificial intelligence (AI), machine learning (ML), and deep learning (DL) in engineering has sparked a heated debate regarding the benefits of automation versus human expertise.

AI technologies have revolutionized the field, offering efficiency, accuracy, and problem-solving capabilities. Extensive manual labour and time-consuming calculations can now be accomplished with remarkable speed and precision, all thanks to AI-driven automation.

## Semi and Fully Autonomous Driving

As a good example, AI technologies have revolutionized the automotive landscape with autonomous transportation. Engineers and researchers have leveraged AI, particularly ML and DL algorithms, to create sophisticated systems that can perceive the environment, make real-time decisions, and navigate safely without human intervention.

## The Challenge of Perception

One of the most critical tasks in autonomous vehicle development is perception, where the vehicle must interpret its surroundings using sensors such as cameras, lidar, and radar systems.

Traditionally, engineers relied heavily on manual labour to develop handcrafted rules and algorithms for object detection, lane recognition, and other perception tasks. This process was not only time-consuming but also prone to errors and inefficiencies.

## Positive Impacts of Technology



SORT CODE : Eng NZ - AI ADVISORY GROUP

---

The impact of autonomous driving on the US workforce presents several positive aspects.

Firstly, it's expected to enhance road safety significantly, reducing accidents caused by human errors.

Secondly, autonomous vehicles handling transportation opens up new opportunities for workers to focus on other value-added tasks during their commutes. Additionally, this technology may lead to increased productivity, as delivery and logistics industries can streamline operations and reduce transit times.

Finally, developing and maintaining autonomous vehicles create new job opportunities in engineering, software development, and manufacturing sectors.

## The Importance of Engineering Data

With the advent of AI and deep and machine learning techniques, engineers now have the ability to train neural networks to learn directly from vast amounts of data. For instance, convolutional neural networks (CNNs) have shown exceptional performance in image recognition tasks, enabling autonomous vehicles to detect pedestrians, other vehicles, and road signs with speed and accuracy.

## AI Applications in the Engineering Field

Will AI replace engineers? We will now focus on this question, showing how AI models and generative AI systems can positively impact daily lives.

Generative Design (Autodesk) - an automotive chassis

CAD and Design Automation The standard design process in industrial product development consists of regular iterations between product designers using CAD and the simulation teams using CAE (Computer-Aided Engineering simulations). At different stages of the development process, with evolving requirements, new designs need to be assessed and improved using standard CAD/CAE tools.



These interactions involve consequent waiting times, and the simulation tools are not always compatible with the requirements of fast-paced projects.

Furthermore, different file formats and the complexity of simulation teams' tools are often further slowing down the process.

Quicker simulation approaches, integrated into design tools, are an attractive alternative. However, most of these so-called "simple CAE" or "upfront solutions" simulation tools have some serious disadvantages. Basically, they lack accuracy, do not correlate well with

the "high-fidelity" simulation, and are limited to a few simplified scenarios proposed by the software vendors.

This sophisticated turbomachinery simulation would be impossible to produce with "simple CAE"

These are the bottlenecks that Neural Concept Shape (NCS) has solved with a new class of AI-based algorithms based on ML and DL.

Shape models handle raw 3D CAD and CAE data, allowing simulation to be conducted early in the design process. This provides designers with simplified and real-time access to simulation results.

Neural network architecture behind NCS, with a self learning model providing a CAE surrogate to solve prediction for engineers

NCS' CAD interface enables product designers to quickly and accurately iterate on designs, resulting in better solutions for customers.

Real-time design exploration: from CAD geometry to CFD results in a few seconds using NCS AI model

AI Adoption in CAE Teams

Engineers remain at the core of the product design process in mechanical engineering and other industries. Using their knowledge and experience, CAE simulation domain experts are now becoming responsible for the quality, update, and deployment of the mentioned AI models.

The applications of NCS are infinite. Example of deformation and stress levels after lateral pole crashing of car battery  
For instance, mechanical engineers' expertise empowers designers with additional AI tools, enabling them to tackle complex engineering challenges more efficiently and accurately and with fewer iterations in the design process.

This symbiosis between AI and engineers is a new workflow, ushering in an era of innovation in CAE software applications for mechanical engineers and engineers in many other industries.

CAD representation of a car ready for CAE simulation (Mercedes)  
Advantages of AI in the CAE Workflow

One of the most significant advantages of integrating AI into the CAE workflow is a much smarter and more automated usage of CAE tools in the product development process.

AI-powered algorithms can assist engineers in automating time-consuming tasks, such as meshing and simulation setup, allowing them to focus on higher-level design decisions and analysis. This saves time and reduces the likelihood of human errors with more reliable and optimised engineering solutions.

## Approaching Problem-Solving With AI Technologies

AI adoption has revolutionised the way CAE teams and consultancy companies approach problem-solving.

With access to AI-driven predictive analytics, engineers can now simulate and analyse a broader range of scenarios, enabling them to explore alternative design options rapidly. This iterative process leads to optimised designs and cycles in the product development process, giving adopting companies a competitive edge.

Furthermore, AI has opened up new possibilities in simulation-driven design optimisation.

By harnessing the power of machine learning and optimisation algorithms, CAE teams can efficiently search

through vast design spaces to identify the most optimal configurations that meet multiple criteria.

This capability not only enhances product performance but also allows for the creation of innovative and cutting-edge designs that were previously challenging to achieve.

## Summary: Why AI Won't Replace Engineers

The ideal approach here is to balance AI automation and human expertise. By leveraging AI as a powerful tool to complement human skills, engineers can harness the full potential of both worlds.

This symbiotic relationship enables engineers to achieve unparalleled levels of efficiency, innovation, and precision while retaining the invaluable qualities of human intuition and creativity.

Embracing AI as a collaborative partner rather than a replacement empowers the engineering community to address complex global challenges and drive progress towards a brighter future.

In conclusion, AI approaches will not replace simulation software or engineers.

AI will rather be used by simulation experts to validate concepts or explore much more complex physical phenomena (such as vehicle acoustics if we talk about a CFD application) while the early development process is done within the design teams.

FEATURE: Will artificial intelligence replace engineers?

12 Aug 2021

Tereza Pultarova



Will AI replace engineers – or will it usher in a 'golden age of engineering'? (Credit: Shutterstock)

When Open AI released the Generative Pre-trained Transformer 3 (GPT-3) language generator in June 2020, many were shocked

The artificial intelligence (AI) program was able to produce pieces of writing indistinguishable from those created by quite skilled human writers. Many asked whether the emergence of such programs spelled the end of journalism as a human profession. There are other disciplines previously reserved for talented humans that today's AI can comfortably tackle. It can write songs that mimic the sound of famous pop stars or create paintings in the style of great masters of the past. In engineering, architecture and design, a new type of AI-based software emerged, capable of creating a multitude of solutions to a problem in a short period based on predefined criteria. The components that AI designs today are so far of a rather basic nature – brackets, housings, forks, support structures. The goal is to help engineers work faster and make them more efficient, according to Paul Haimes, vice-president at digital services and Internet of Things company PTC, which develops generative design solutions. But what is going to happen next? “Generative design builds on the heritage of CAD but takes away the iterative process from the desktop of the

engineer and puts it into the cloud environment,” says Haimes. “We are allowing the computer to do the iterative work that previously would have been done by the engineers. The engineers get a range of options to choose from, but it's still the engineer who is making the decision.” Haimes says that, thanks to the speed at which the computer produces the iterations, the resulting product is better optimised. That leads to cost reductions, greater reliability and streamlined manufacturing. “It's not an automated process, it's assisted,” says Haimes. “In the future, we will continue to include more and more design goals, but there will always be a role for the engineers. We are not replacing them.”

Who will survive?

The World Economic Forum has been following the evolution of AI for many years. According to the forum's 2020 *Future of Jobs* report, new opportunities spawned by the expected growth of the AI industry will eventually outnumber the jobs that will be lost. But the forum's head of AI and machine learning, Kay Firth-Butterfield, agrees that not all technical professions will be spared.

“It’s getting much more important to get into more complex roles because the computers will be more and more able to do the basics,” says Firth-Butterfield. “There will always be opportunities for people who have PhDs, people who are thinking about new ways of developing tools or starting businesses that will use AI to solve various problems. Those jobs will survive. Jobs that involve basic coding probably not so much.” Ultimately, Firth-Butterfield believes, AI will usher in the “golden age” when engineers will be able to focus on “the fun things, and the AI will support them”. Mark Girolami, professor of civil engineering at Cambridge University, and the Royal Academy of Engineering research chair in data-centric engineering, shares the excitement. “Some jobs will disappear, but new ones will emerge,” says Girolami.

“Forty years ago, we needed draughtsmen to draw technical drawings. That’s all automated now. But we now need a lot of software developers and engineers who are freed from drawing and copying and able to consider the more high-level issues. Jobs transform in response to what’s going on societally and that’s good. It’s going to make society safer and jobs more fulfilling.”

Girolami, however, cautions that the profession cannot sit around and wait for things to change. It must proactively prepare for the AI-driven future and make training in data-centric sciences a cornerstone of engineering education.

## Slower progress

Girolami and Firth-Butterfield agree that, one day, AI will get so good that it will be able to take over the creative design process completely. It will be able to further develop itself, making all data scientists who train and develop it today redundant. But this moment still seems quite far in the future. “Deep learning is incredibly powerful for very specific problems, it’s good for simple, very constrained types of designs. But for the more generic, mental-level problems such as creative design, there is still quite a way to go,” says Girolami. “When I was at university, everybody was talking about AI doing this and that, but it still hasn’t happened. We have moved closer to it. It will happen at some point. But whether that will be in 10 years or 30 years, that’s difficult to say.”

Firth-Butterfield agrees that the pace of progress doesn’t match the expectations. The World Economic Forum predicted only a few years ago that the profession of truck driver would soon become obsolete because of autonomous vehicles. The task to automate driving, however, proved more challenging than expected. “We used to think that lorry drivers would soon be out of work, but it is proving much harder to do even on the sort of roads that we have in America, which are much easier for autonomous vehicles to navigate than, for example, streets of London,” says Firth-Butterfield. “The promise of AI is there, but we still have a number of nuts to crack to say this is going to be

fully autonomous.”The slow progress, says Firth-Butterfield, is largely owing to the shortage of computer scientists capable of developing AI algorithms and training the machines. Ironically, she adds, to become an AI developer may not be the safest career choice. “Now, we need to educate a lot of people because we need a lot of people to do the work,” she says. “But come 2030, 2040, those people are all going to be looking for new jobs because AI will be able to do their job itself.”

## Reluctant adopters

Haines doesn't expect AI to overtake the engineering sector any time soon. In fact, he says, despite engineers' propensity for new technology and assumed geekiness, the profession might be among the last to embrace this innovation. “Engineers are very data-driven people, they want to know whether the technology has been proven to work,” says Haines. “They want to be able to understand what's happening in the background and whether they can trust the system. They are not going to commit to it unless they have a full evaluation of how it works and it's proven that it's successful.”

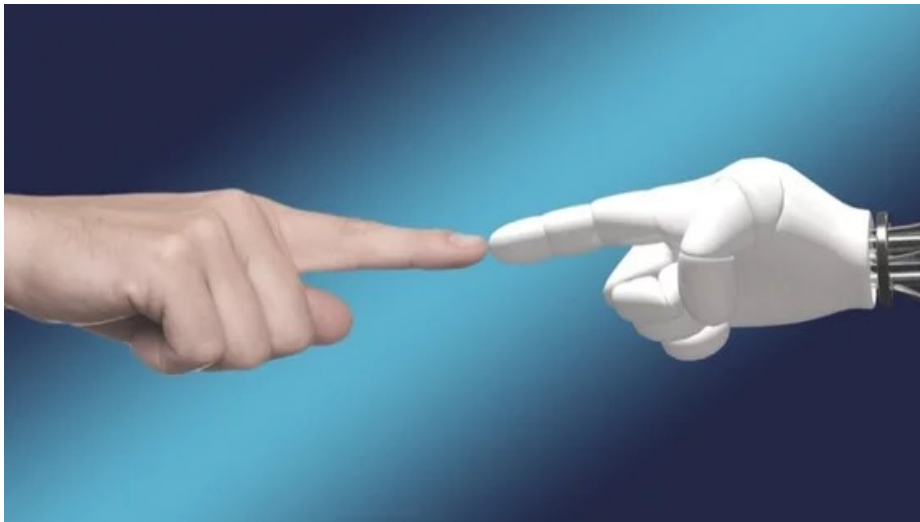
The engineering community is particularly concerned about the fact that current AI applications run in the cloud, adds Haines. The

companies don't have control over the systems and data centres and prefer not to take security risks with their intellectual property.

“Engineering and manufacturing is probably one of the last industries to truly embrace cloud,” says Haines. “That will change over the next five to 10 years. And that's also the timeframe in which I expect generative design to really get into the mainstream adoption phase and become embedded in most CAD applications.”When it comes to the future of AI, Firth-Butterfield believes that it is in the hands of the humans who are developing it today. AI doesn't need to replace musicians, writers, painters or engineers if humans don't want it to. “Technically, AI will one day reach the point where it can replace engineers, designers and architects,” she says. “But it's up to us to decide what we want to use it for. And I suggest we should focus on using it on solving some really painful issues that we face, such as curing diseases, rather than taking away the jobs of engineers, architects or journalists.”

•

- 
- THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE ENGINEERING PROFESSION



## STACEY PHILLIPS

Over the years, movies have often featured intelligent machines ruling our lives—think Optimus Prime in *Transformers*, *The Terminator* and

Sonny in *I, Robot*. They all had one thing in common—the use of Artificial Intelligence (AI).

Although there is no universally accepted definition, a popular textbook defines AI as systems that think like humans, act like humans, and think and act rationally.

AI is changing our world. Many people today are already accustomed to using it in some aspects of their lives. We talk on our “smart phones,” use robotic vacuums or ask SIRI where to find the nearest grocery store.

Although the term AI was first used at a Dartmouth College conference in 1956, it was not until the last decade that advances in the technology have become more widespread.

In September 2016, five large technology companies came together to create the “Partnership on AI to benefit people and society.” They included Google, Facebook, Microsoft, IBM and Amazon. Apple joined as a founding member four months later. The non-profit organization’s website, says it was “Established to study and formulate best practices on AI technologies, to advance the public’s understanding of AI, and to serve as an open platform for discussion and engagement about AI and its influences on people and society.”

With these and other recent advances in AI, many engineers fear their jobs will be taken over by automated systems. According to a study by Oxford University, nearly half of the jobs in the United States are at risk of being automated over the next decade or two.



Is it possible for engineers to be replaced by the same systems and machines they created? It is not likely. A study on One Hundred Year Study of Artificial Intelligence, released by Stanford University in September 2016—“Artificial Intelligence and Life in 2030,”—reported there is no imminent threat to workers. Instead, it is expected that the useful applications that will be the result of AI will have a positive impact on society.

Imagine special robots that clean your house or office, deliver packages or teach tutor you children in mathematics. Although routine work and simple tasks may eventually be replaced by machines, there is enormous potential for the engineering profession across all disciplines.

Many say that those with a good background in STEM (science, technology, engineering and mathematics) will continue to be in high demand. Although computers are very good at tasks that require precision and speed, such as playing chess or driving a car, computers, at least for now, can not figure out how things work. As AI continues to develop, many jobs will require collaboration between humans and computers.

Five ways in which AI may impact the engineering profession:

1. History has shown that technological advances in the past have helped create new jobs. This will be especially relevant for those in the engineering community.

2. With the rapid evolution of technology, there will be an increased need for engineers to research, create and test AI systems.
3. Engineers have an enormous opportunity to showcase their creativity in response to advances in AI.
4. New types of experts will increasingly be in demand in response to the new types of work created by AI technology.
5. New developments in AI will enable engineers to complete their work more efficiently and solve a wide range of problems.

As AI continues to adapt and become part of our daily lives, engineers will not only work with this technology but be part of its development and future.

- ChatGPT has brought artificial intelligence (AI) to the forefront of the news lately. While NSPE has always been involved in emerging technology, it is clear to me that we must be involved in the growth of AI to ensure safeguards are in place and that ethical standards guide and govern its development and deployment.

A newly released version of ChatGPT (ChatGPT-4) took the bar exam and scored in the 90th percentile, according to recent news reports. Upon learning this, my first thoughts were filled with the many lawyer jokes this could spark but, in deference to our friends in that profession, I will not go down that path. On a more serious note, it did make me wonder what this development potentially means for the profession of engineering and to PEs specifically. So, I did what I

thought was the most logical first step, I asked ChatGPT the following question: Will AI be able to design work currently being done by professional engineers?

The answer: "AI has already demonstrated remarkable ability in various fields, including engineering. However, it is important to note that design work currently being created by professional engineers involves a high level of complexity that goes beyond what currently AI is capable of....That being said, there is ongoing research into developing AI systems that can design complete systems... However, it is unlikely that AI will completely replace professional engineers in the near future, as the human element is still crucial in the design process."

I was a bit surprised by the answer and definitive nature of the response, but after doing more research on the subject, the answer seems to be in line with the thinking of those developing the technology.

Using artificial intelligence and machine learning can provide us with a powerful tool to augment our work. In my own case, I work for a small city public works department that has benefitted from this technology.

Through partnership with a local university, we recently used AI and machine learning to evaluate the condition of the pavements of our road network. The system identified pavement distress and severities using video images. Normally, this type of effort would take a human using a somewhat subjective standard many days or weeks to accomplish. These innovative tools permitted us to complete this project in a fraction of the time and with results that were objective and easily repeatable.

This is just one example of how AI can improve our work. There are thousands of other examples that exist in the areas of design optimization, remote inspection, and new product testing. But just like with each past technological innovation developed for our profession, the rollout and use of AI must be done with intentionality and safeguards. By doing so, we ensure its deployment is done ethically and responsibly. We, as the end users, must know and understand its capabilities and limitations.

What does this mean for the profession of engineering? As stated in our creed, we must hold paramount the protection of the public health, safety, and welfare. So, if this technology is upon us, how do we

provide that vital protection? So, again, I asked ChatGPT a question: If AI does advance in engineering design, how will we ensure that ethical standards are maintained in the process?

The answer: "...maintaining ethical standards in AI-driven engineering design will require a combination of guidelines, regulation, oversight, and human expertise to ensure that these systems work in the best interest of society and do not create unintended harm."

In a recent episode of the 60 Minutes news program, Sundar Pichai, the CEO of Google, stated, "There has to be regulation. You're going to need laws...there have to be consequences ... Anybody who has worked with AI for awhile...realize[s] this is something so different and so deep that, we would need societal regulations to think about how to adapt."

Additionally, the Future of Life Institute, a nonprofit organization that works to reduce global catastrophic and existential risks facing humanity (particularly exponential risks from advanced artificial intelligence), published an open letter stating in part, "...Powerful AI

systems should be developed only once we are confident that their effects will be positive, and their risks will be manageable..."

I agree with these assessments. As I have read about and researched these issues, it has become abundantly clear that professional engineers must engage in the evolution of AI.

Over the past three years, the NSPE Software Professional Certification Task Force has worked with subject matter experts to find ways in which we can be part of a solution being called for by the computer industry. Our goal is to create a certification process that effectively evaluates competencies and ethical standards for developers. This system could be a piece of the safeguards called for by Google's CEO and many others who are working in the development of AI.

Professional engineers must be involved in the development of AI. It's also critical that we ensure that the development of AI regulations makes protection of the public a top priority intelligence going to design your next building?

## Is artificial intelligence going to design your next building?

In recent years, AI and machine learning tools have made the leap from interesting-in-theory to uncanny-in-practice. Armed with huge data sets and considerable processing power, developments like GPT-3 from Open AI, have surpassed their creators' predictions, and are seemingly capable of producing competent, cogent and compelling prose, poetry and even pictures to order. Many were surprised, impressed, or even shocked by some of the capabilities shown by GPT-3 when it debuted in summer 2020, with reactions ranging from the slightly alarmist 'Are you scared yet, human?' in The Guardian, to inspiring droves of start-ups to build new businesses and services around it.

So, what might GPT-3's descendants be like some years from now, given its seeming uncanny ability to generate convincing text (and in other variants, images from a textual description) from a short prompt? And how might it impact the architectural, engineering and construction industry? Might it be possible to ask artificial intelligence to 'design me a building'?

A machine learning partner for designers and engineers?

GPT-3 has the ability to discern meaningful patterns from billions of different elements of human writing, enabling it to seem to pass something like the Turing Test. You write a sentence or two and it is able to continue your line of thinking, developing it into paragraphs of copy or if using its off-shoot 'DALL-E', produce images that variously

reflect what you'd requested. So, might it be possible to ask of GPT-100 to "design me a building"?

Well, for one thing we would need to be more specific: the building 'that fits this plot of land', that it 'it has net zero carbon emissions, has 5 rooms, big windows etc.' It would be hard to describe precisely what's required with words alone. More importantly, we are more aware than ever that we live in an interconnected world, that's changing fast. So, the building must complement its neighbourhood, make efficient use of materials and energy, and present good value for money compared to alternative uses and schemes. The industry already uses **parametric design tools** to unify these different goals in a rigorous and imaginative ways, based on a blend of highly relevant discrete data sets. It's not yet clear that a generative pre-trained transformer (GPT) machine learning tool will be helpful in navigating the multi-dimensional reality and constraints of a building project. Well, for now, at least.

As a highly competent language model based AI, GPT-3 is a very impressive achievement – but other forms of artificial intelligence are also making advances. GPT-3 also embodies some of the weaknesses of current artificial intelligence technologies: inscrutability. The data it draws on is phenomenal in size but will certainly contain biases, is likely not publicly available for inspection or assessment, and data-sets on which it draws are likely to be owned by private companies with their own commercial agenda. This is leading towards a looming ethics issue as we use more data in the built environment, and direct human agency is replaced by the decision making powers of ever more competent machine learning tools.

## Science and machine learning join forces

As architects, designers, engineers and planners, we work in a complex and dynamic context – we are concerned with not just how things are now and have been, but what they will be like in the future. Beyond the impressive creativity of GPT-3, what we as a community really need are insights into the real-world contexts into which our design decisions must succeed and endure. We need to know how strong a region's storm winds might blow or how much rainfall future storms might produce, how will the climate affect ground water or a myriad of other factors that increasingly challenge the built and natural environment. Machine learning's ability to discern patterns and make predictions under incredibly complex sets of conditions might be more what we need.

Another area that shows great promise is the emerging convergence between machine learning and science, leading to new technologies that build on the huge body of knowledge in mathematics, physics and other sciences. Traditional computing methods have become more powerful but even today the level of computing power required can be expensive and slow to use. In the built environment industry modelling and simulation are areas where we need continuous improvement in speed, scale and complexity of computing tasks. Machine learning tools with GPT-3-like ability to consider billions of factors simultaneously, trained on larger data sets, should enable us to make a quantum leap as we study scientific alternatives, find optimal solutions, and handle more complex models. This would be very valuable on typical fluid flow phenomena such as wind, atmosphere, water flows, structures, materials, chemistry and other hard to compute elements. Here at

Arup, we have already been experimenting with AI accelerated air flow simulations (the interaction of wind with buildings). In the past these have played a limited role in design and typically only one or two cases have been studied (because of their time and computational cost). This new approach (although the technology is not yet fully mature) promises far more freedom to explore options and reach optimal solutions more quickly.

In the case of flood prediction, we see AI models that have learnt from historical data and are informed by physics, being far better able to generalise to, for example, an extreme storm event in a future climate and we are already beginning to test this approach on projects.

Machine learning and the planet

With net zero commitments taking effect across the built environment industry, our industry is going to be increasingly (and rightly) expected to answer tougher questions about the designs we propose and the energy and emissions those solutions might produce. This is another area where machine learning can help us navigate complexity.

Given the lifespan of buildings and infrastructure, we will need to develop more and more powerful machine learning tools to answer questions about the world these projects will join: from the effects of rising oceans, more powerful storms and flooding, to greater rising temperatures and extremes of cold. Climate modelling tools that can make increasingly accurate predictions will be invaluable as engineers and designers adapt their own decision making in a rapidly warming world.

SORT CODE : Eng NZ - AI ADVISORY GROUP

---

At the more tactical level we've already begun taking advantage of the power of machine learning to assess the most effective combination of systems and technology, to help **Whole Foods supermarket chain meet net zero regulations in California**. This 'genetic algorithm' approach allows staggering numbers of combinations of chilling, lighting and air-conditioning systems to be evaluated, with the tool able to emulate evolutionary presses to weed out the weaker solutions, until a range of low emission, high performance options were defined. It's an exciting example of what might be commonplace soon.

The machine-human partnership has only just begun

While we often speak of a 'design language', buildings aren't the same as language models and we shouldn't expect to this type of machine learning to displace the normal, highly multidisciplinary design process. But even if we aren't likely to be asking software to design our next concert hall or cathedral quite yet, machine learning remains an exciting and developing realm for built environment practitioners. It is clearly a 'force multiplier' that can augment our own, human abilities and creativity, in ways we can't even fully imagine yet.

For now, developments like GPT-3 offer a tantalising preview of the scale of engineering and design questions we might answer tomorrow, as well as highlighting the importance of ethical, open data for the whole industry to work from.

Learn more

