

DEMYSIFYING DIGITAL: AI

What is AI?

Artificial Intelligence (AI) is a broad branch of computer science. There are a range of opinions on the true definition of AI, but it can be simplified as, “the science and engineering of making intelligent machines, especially intelligent computer programmes” (IBM, 2020).

AI as a field covers many areas including: machine and deep learning, as well as natural language processing.



Types of AI

There are two main categories that AI can fall under: **Narrow AI** or **Artificial General Intelligence (AGI)**. These are also sometimes referred to as “weak” and “strong” AI respectively.

Narrow AI is the most prevalent form of AI in the world today. Focusing on completing specific

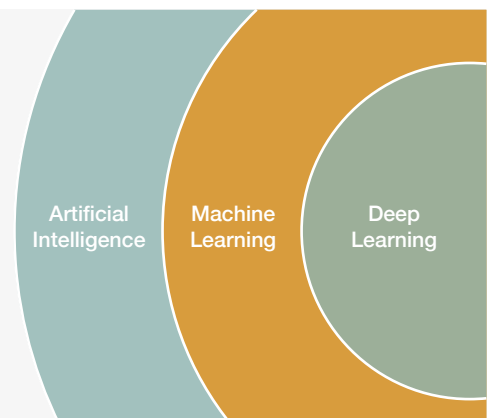
tasks, the remit is narrow but it does not stop it from having very powerful and robust applications. These might include, voice assistants (such as Alexa, Siri and Google). IBM’s Watson, internet search engines, image recognition software and self-driving cars are other examples of narrow AI.

AGI is a system that is self-aware and can learn and solve problems by itself. This is a theoretical system where machines would have a level of intelligence equal to or greater than humans. In many respects this is seen as the holy grail of AI research and examples in popular culture include **Hal** from ‘2001: A Space Odyssey’ and **C3-PO** from ‘Star Wars’.

Machine Learning and Deep Learning

As previously mentioned, machine learning and deep learning are often equated with artificial intelligence. These terms can often be confused.

Venture capitalist **Frank Chen** usefully describes how to differentiate between them, “*Artificial intelligence is a set of algorithms and intelligence to try to mimic human intelligence. Machine learning is one of them, and deep learning is one of those machine learning techniques.*”



Hierarchy of Artificial Intelligence and its sub-fields (IBM, 2020)

Applications in engineering

The application of AI in engineering today is quite limited, as AI is usually predicated on analysing and using data. It can be tricky to monitor structures with long lives as we have only recently developed monitoring capabilities and do not have detailed data over the whole life span of a bridge for instance.

Other potential applications of AI in engineering could include a classification algorithm that could spot potholes in the road network, and self-healing and intelligent infrastructure. For example, a bridge that is covered with sensors and “feels pain.” It could potentially react to this by alerting

maintenance, closing a lane and enforcing a reduced speed limit to protect itself from further harm. National Highways are currently exploring a similar concept.

These are only a few of its potential applications. [Click here to read more.](#)



Despite the general ever-growing interest in AI, there exists a clear reluctance to its application to Civil Engineering infrastructure, mostly due to the lack of quality data. However, this situation is changing thanks to the promising results provided by new hybrid algorithms, which combine the well-known laws of physics with data-driven methods. The future of Civil Engineering lies in large-scale data collection through low-cost sensors and the proactive education of our engineers in the application of AI technologies.

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Key takeaways

- 1 AI is a hot trend in many industries. Care has to be taken to avoid the hype and take a measured approach to the technology.
- 2 Focus on gathering high-quality structured data. Data is an extremely valuable commodity that could be better utilised in the industry.
- 3 Physics-informed neural networks will one day be able to overcome a lack of data and will lead to greater insights, as well as more powerful applications in the future.