

Demystifying Artificial Intelligence for the utility industry



Artificial Intelligence (AI) has now reached a level of maturity that allows utilities to implement different use cases safely. To do this, they must first understand the basics of AI, learn about its different types, and be able to tell truth from myth as well as know how AI impacts utilities.

Introduction

Mimicking the intelligence and behavior of the human brain with technology has long been a dream for mankind. Since the beginning of the technological era, humans have attempted to make computers intelligent, but as computer scientists get closer to this goal, an important question arises: What exactly is meant by "intelligent"? What makes a computer's behavior "intelligent"?

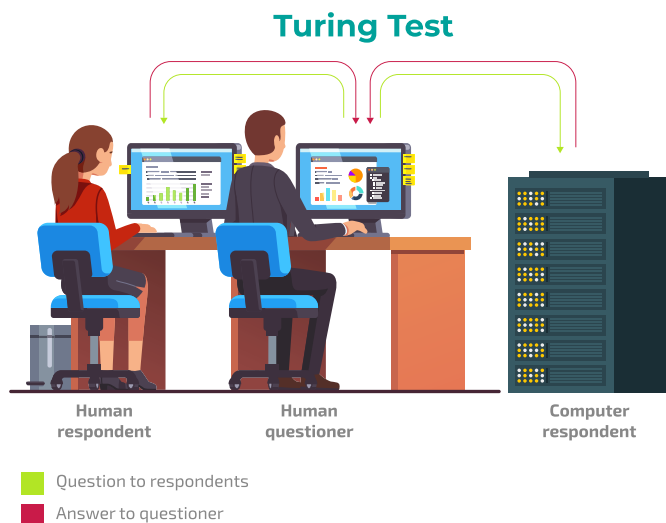


Figure 1. Turing test.

To answer these questions, the renowned mathematician, computer scientist, and father of Artificial Intelligence, Alan Turing, conceived a test to verify a machine's ability to exhibit intelligent human behavior. In the Turing test, a human interviewer is asked to chat with two subjects: one of which is a computer and the other which is a human. After interacting with both subjects, the interviewer has to discern which of them is sustaining the conversation. If the interviewer is unable to identify which subject is human, then the computer (or the chatting algorithm to be precise) passes the test.

Since then, AI as a technology and research field has had several hype cycles, including many dissolution periods where researchers lost interest, most recently in the 1990s. However, since 2012, AI has gained a lot more traction in both the scientific community and the mainstream media. This increase in interest is driven in part by the 4th industrial revolution and the need to

understand the ever-growing amount of data that is being generated in real-time. In fact, it is predicted that by 2025 worldwide data will grow 61% and reach up to 175x zettabytes annually - that is 175 thousand million terabytes.²

Types of AI

Making sense of vast volumes of information is just one use case. There are several other AI business cases that companies can implement to enhance their operational processes. To leverage the power of this technology, utilities need to understand AI as an umbrella concept and the many subsets or types of AI within it. The following table provides key information about the most utility-relevant types of AI as well as their benefits:

For short, AI is any technique or algorithm that enables machines to solve a certain task in a manner similar to a human. Therefore, any type of algorithm that allows a computer to solve problems and arrive at similar or better conclusions than humans is considered AI

Types of AI	Description	Benefits
Planning, scheduling and optimization algorithms	Algorithms that target the optimization of routing, scheduling or planning problems. This type of AI is the most mature and has been researched since the 1900s.	Optimizing utility's resources, such as available time, trucks, schedulers and field technicians.
Machine Learning	Algorithms that enable computers to learn from examples without being explicitly programmed. Techniques like Artificial Neural Networks (ANN) and Deep Learning (DL) are subsets of Machine Learning.	Knowing beforehand variables such as workforce capacity or levels of service usage, allowing the utility to prepare for the future.
Natural Language Processing	Also known as NLP, it is the field of AI that recognizes human speech and turns it into instructions that machines are able to understand.	Enabling more alternatives to build a strong and healthy communication with customers.
Vision	Also known as digital image recognition, this type of AI specializes in recognizing objects in images, allowing computers to understand the images or videos uploaded to the algorithm.	Enhancing software solutions to allow them to interact with real-world images and understand situations such as worn-out components like insulators.

Table 1. Types of AI.

1. ENCYCLOPEDIA BRITANNICA. Turing test. <https://www.britannica.com/technology/Turing-test>
 2. IDC (2018). The Digitization of the World From Edge to Core. <https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf>

All of the types of AI mentioned above have reached a maturity level that create incentives for companies to deploy them. In fact, statistics indicate that by 2022, 75% of enterprises will use AI-based software to discover operational and experiential insights to guide innovation³. Such a relentless widespread adoption of this technology blazes the path for utilities to harness lower entry barriers and a higher degree of sophistication of AI applications.

AI myths in the utility industry

As new technologies approach on the horizon, it is common for misleading myths to surround them. The myths around AI have been no different, with some suggesting how it will affect utilities and daily human life. Some of these myths are feasible and practical, while others seem far-fetched beyond reality.

Myth 1 - Super-intelligent computers will replace human jobs



Truth Meter

Oxford Economics says that global trends point to 20 million manufacturing jobs lost to robots by 2030. In fact, as of 2019, there were about 2.25 million robots doing manufacturing jobs⁴. Of course, AI will not only affect manufacturing, it will also impact most low-skilled jobs, with up to 47% of American jobs at "high risk" of automation by the mid-2030s⁵. That is why experts recommend companies to train some of these workers to perform highly skilled jobs. The employees that will most likely be disrupted in the case of utilities are those who perform clerical work such as office jobs, scheduling, and dispatching.

Myth 2 - AI is smarter than humans



Truth Meter

There is an average of 86 billion neurons in a human brain⁶. Even though it is impossible to calculate precisely, it can operate at 1 exaFLOP (equivalent to a billion billion calculations per second). The fastest computer in the world as of 2020 is the Fugaku from Japan, capable operating of 415.5 petaFLOPS, a whole order of magnitude short of a human brain⁷. Additionally, a major drawback for computer intelligence today is that current AI is narrowly intelligent, meaning that it is extremely good at one task, like detecting when a device needs maintenance, but would fail at any other task. A type of AI, known as General AI, that can solve any kind of problem is being researched, but achieving this type of intelligence may take decades.

Myth 3 - Not all companies need an AI strategy



Truth Meter

AI is here to stay. Even though utilities have been a traditionally slow-evolving industry, now is the perfect time to start researching this trend and obtain all the benefits available today. These companies should develop a blueprint that allows them to define the scope of the AI applications required according to their unique business needs, preventing them from venturing into complex implementations of cutting-edge technologies that may be less profitable.

3. Forbes (2019). Top Artificial Intelligence (AI) Predictions For 2020 From IDC and Forrester. <https://www.forbes.com/sites/gilpress/2019/11/22/top-artificial-intelligence-ai-predictions-for-2020-from-idc-and-forrester/#6678d338315a>
4. Oxford Economics (June, 2019). HOW ROBOTS CHANGE THE WORLD. <https://www.oxfordeconomics.com/recent-releases/how-robots-change-the-world>
5. Forbes (July, 2019). Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work. <https://www.forbes.com/sites/gilpress/2019/07/15/is-ai-going-to-be-a-jobs-killer-new-reports-about-the-future-of-work/#72c87bb4afb2>
6. The Human Memory (September, 2019). Brain Neurons & Synapses. <https://human-memory.net/brain-neurons-synapses/>
7. Science Node (June, 2020). The 5 fastest supercomputers in the world. <https://sciencenode.org/feature/the-5-fastest-supercomputers-in-the-world.php>

Myth 4 - A company needs a data lake to train AI



Truth Meter

It is a common belief that in order to implement AI, a company needs huge data lakes to train their machine learning algorithms. While this is partly true due to the nature of the learning processes of these types of AI, training them with too much data may result in overfitted algorithms. Considering this, utilities need to assure that they have the right data about their customers, crews, devices, and processes to train any type of AI.

5. Feature engineering: Groups and categorizes the information in a way that can help the AI make better sense of it.

6. Splitting data into training and evaluation sets: Splits data into two sets, one to train the algorithm and the other to test the algorithm to verify it has learned and can correctly understand the processed data.

Myth 5 - AI can find valuable information from any data



Truth Meter

Machine learning algorithms are trained with a specific data set that must go through the following six steps before being fed into an AI:

- 1. Collection:** Finds data with relevant attributes.
- 2. Exploration and profiling:** "Cleans" the data by looking for trends, outliers, exceptions, incorrect, inconsistent, missing or skewed records.
- 3. Formatting:** Ensures that all records are formatted equally (e.g. February 15th, 2020 vs 02/15/2020).
- 4. Quality enhancement:** Looks for records that may be missing or that contain extreme values.

Conclusion

AI has been around for almost as long as computers have existed and only recently has it begun to catch the general public's attention. Today, the market is seeing more and more real-world applications that yield positive results. Thus, by merging this technology's advancements and their valuable data, a window of opportunity is created for utilities to implement different types of AI that allow them to optimize their processes and provide a better service to their customers while reducing operational costs.



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Whitepaper "Demystifying Artificial Intelligence for the utility industry".

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