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# When humans meet algorithms

by **Dr Eva Savelsberg**
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**"You are my creator, but I am your master." These chilling words from Mary Shelley's novel *Frankenstein* were first published on January 1, 1818, amidst the First Industrial Revolution, a period of great social and technological change. Considered by many to be the first work of science fiction, the story influenced not only literature, drama, and film, but also the public's perception of science. This year being *Frankenstein*'s 200th anniversary, and at the dawn of the Fourth Industrial Revolution, the myth of a creature turning on its creator seems more relevant than ever before. Having escaped the laboratories of many tech companies, Artificial Intelligence (AI) is poised to change our society for good.**

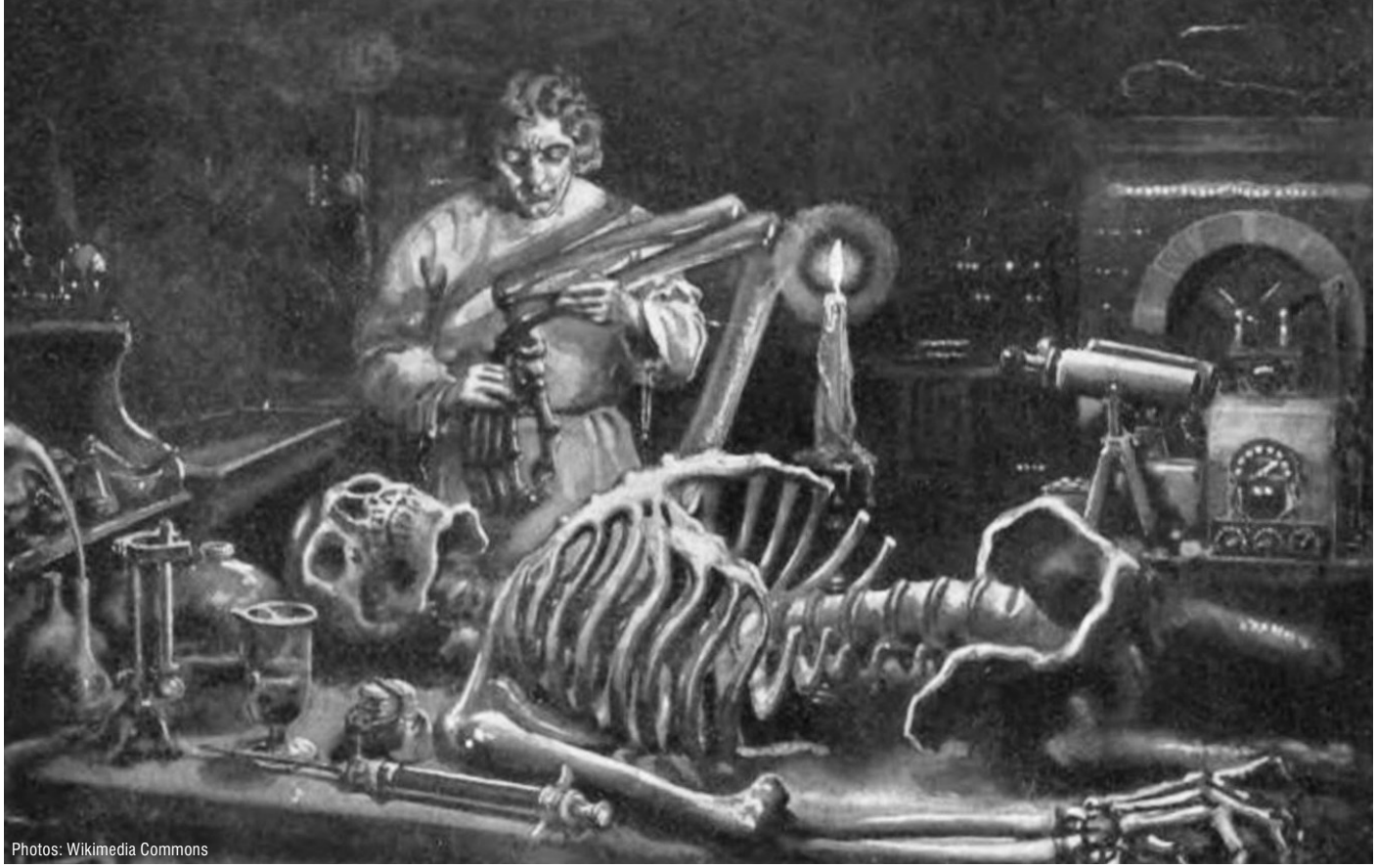
While human-level AI is not yet looming around the corner, we constantly carry some form of AI in our pockets already today. The irony is that Siri, Alexa, and Cortana, while comparable to the Frankenstein's monster in so many ways, aren't perceived to be frightening characters. Rather, these AI-enhanced assistants have become an ordinary, if not an integral part of our lives and workplaces.

This article will take you on a journey to the past, present, and future of AI. To unpack this story, we need to have a few stops along the way. Firstly, we need a quick reference point of what AI is and how it relates to other IT developments, e.g. machine learning. Then, it is worth identifying why INFORM is qualified to speak on the subject. From here we will explore how AI is being applied in the container terminal market today. Finally, we'll discuss what the role of humans is likely to be in the future and whether any of us will have jobs.

### The simple AI-ML-OR truth

Artificial Intelligence is an area of computer science that's concerned with building systems that demonstrate intelligent behaviour. Most people find it difficult to agree on a precise definition of intelligence, so views of what AI means also tends to diverge. For most people, when they hear the term "Artificial Intelligence," they think of a General AI or a human-level AI that can mimic all aspects of human intelligence. The simple truth, however, is that today AI is far from this. Instead, AI vendors have succeeded in building niche, so-called Narrow AI systems that know how to do reasonably specific things very well (for instance, play chess, understand natural language, translate between often very different tongues,

INFORM specializes in Agile Optimization Software to improve operational decision making. Based in Aachen, Germany, the company has been in the optimization business for nearly 50 years and serves a wide span of logistics industries including maritime and intermodal terminals.



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or drive autonomous vehicles). It is these Narrow AI systems that are now making their way into our industry at a rapid pace as part of the Fourth Industrial Revolution.

In contrast with General AI's goal of mimicking human intelligence, machine learning (ML) tools use algorithms to iteratively learn from and adapt to data, enabling computers to find hidden insights without being instructed where to look. A beginner's example for this can be found in your email inbox in the form of spam filters. Simple rule-based filters are not very effective against junk mail, since spammers can quickly update their messages to work around them. Instead, ML-enhanced spam filters continuously learn from a variety of signals and tailor themselves to the email needs of the individual user.

Operations research (OR), also referred to as "the science of better", uses analytical methods (mathematical optimization, heuristic methods, and so forth) to analyse and consider vast amounts of data to optimize the planning and real-time control of processes. Depending on one's view, OR is either a means to an AI outcome or the two can be complimentary disciplines.

When you think of AI as the area of computer science that is concerned with building systems that demonstrate intelligent behaviour, one could say that OR is part of AI. From a classical research perspective, this is inaccurate because OR and AI are two separate disciplines that have independently developed intelligence-based computing techniques. However, if one takes the broader definition of AI, with building systems that demonstrate intelligent behaviour, OR could be classified as a part of AI. Alternatively, AI is a technique that makes better predictions about the data that is fed into OR optimization algorithms.

Either way you choose to view the relationship between OR and AI, INFORM has been working with AI for over two decades, with commercially available products in use since the early 2000s. More than 20 years ago, we started developing knowledge-based AI systems pertaining to the concept of using fuzzy logic and fuzzy reasoning for representing human knowledge. Over the years, we've added ML as a second area in our AI activities and the two are now working together in parallel.

**What's in it for my container?**

As described in another place, in the article *Power up your TOS* published in *The Journal of Port and Terminals*, our OR-based Optimization Modules (OMs) work in conjunction with an existing terminal operating system (TOS) to drive terminal efficiency. This "add-on" relationship allows terminals to implement the power of OMs without significant changes. Further, in most cases OMs work in the background without direct user interaction. Workers interact with their existing software environment while benefiting from optimization with no timely retraining required.

To further enhance the decision-making quality, the same add-on relationship can be used to connect a ML platform to the optimization process. There are basically two use cases. First, to analyse data to fine-tune the models and rules of the OM. Second, to analyse data to improve data quality that is fed into the OM.

Optimization Modules typically run on a mixture of different data, e.g., estimated time of arrival/departure of trains and ships, the travel speeds of automated stacking cranes or rubber tyred gantries, container bookings, and truck gate-in registration. Some of these are often based on average or historical values, like the times of truck check-ins or incoming trains prechecks. While this level of quality is sufficient to make the best-informed decisions, values offering higher precision at this stage can improve the calculations. Here's an example: a time slot management system provides shippers the ability to book allocated inbound arrival time slots. However, delayed deliveries are commonplace and actual truck arrival times may vary over the course of a business day (off-peak vs. high-peak). In fact, they may vary on different weekdays, be affected by weather conditions, or even be different for particular hauliers and/or drivers.

The ML will analyse huge amounts of data very quickly and present any findings and correlations in easy-to-digest dashboards to create insights for humans. These, in turn, can form the basis for expert discussions. In cooperation with INFORM, the outcome can be used to fine-tune the models and

rules of the optimization module or, alternatively, the insights from ML may be fed back automatically into the software where they replace previous average or historical values.

Besides data from the TOS and OMs, ML can also be connected to various other internal and external data sources (port community systems, weather apps, etc.) to further enrich the database. Machine learning can be operated all day round, or on a periodic or on an event-triggered basis.

**Is it alive?**

In the riveting laboratory scene when the monster is brought to life, Victor Frankenstein shouts, "Look! It's alive." Today, computer programmers can have similar moments when they develop chatbots. In fact, these pieces of code are one of the most common AI-based applications. They are designed to sound and type like human beings and continuously learn and develop through AI and ML.

To make the latest technologies and applications available for the terminal industry, INFORM recently released a chatbot add-on for their maritime and inland terminal solutions. It receives both voice and text-based queries from a broad range of input sources, recognizes the request, searches for the answer, and sends the answer back as a text response in real-time. The chatbot quickly allows a status check of key performance indicators (KPIs), containers, and/or equipment without calling anyone. Management, with no previous training in the system, can ask the software directly to quickly access KPI data on the fly and in a manner that is convenient to them.

***Frankenstein* reloaded?**

Two hundred years later, we find ourselves at a prologue to a new Frankenstein story. What are the lessons learned? One of Dr Frankenstein's gravest errors was to neglect his creation. He fled from its presence, giving up on the opportunity to supervise, nurture, and educate his invention. Today, the aim of AI development should not be to make a "digitized being" better than us, but rather to make "it" beneficial to us.

Technology moves ahead, but so does the human mind and our attitude towards technology. A senior operations manager from the baby boomer generation might have a different opinion on the usefulness of chatbots compared to a millennial management trainee. Also, a seasoned straddle carrier driver will be more hesitant to accept decisions and work orders from an AI system than a digital native who is about to start a career in our business.

By 2025, Millennials will make up 75% of the global workforce. They have grown up with very fast communication capabilities and high-tech is woven into all aspects and areas of their life. What's more, the generation born after 2010 – the "AI natives" – will only know a world with artificial technology (read more in the article *Born digital. Millennials in maritime logistics*, featured in the 1/2018 printed edition of the *Harbours Review*).

How we manage this human transition is going to define our industry. At this point, there are more questions than answers, such as how do we best utilize highly skilled staff who are in traditional roles? How do you prepare these staff for the future and how will their roles change? If we retrain them, who bears the financial and social costs? How do we attract a young, millennial-aged workforce that have the new skills we'll need in the future (find out more in the piece *How to hire – and keep – the best. Employee experience* in the same printed issue)?

To position ourselves for the future, it is the role of all stakeholders in the port industry to take a degree of responsibility. The question isn't whether AI is coming or not, but rather will we, as an industry, finds ourselves well-prepared or maybe rather caught off-guard when we realize that AI is here. Or, as Mary Shelley wrote in *Frankenstein*, "Nothing is so painful to the human mind as a great and sudden change." ■