

AI &

Water management

What utilities need to know now

Presented by

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Ready or not, here AI comes: What every water utility needs to know

Since OpenAI's ChatGPT broke into the public sphere in November 2022, anyone who logged on fast enough—and that was a [record-breaking number](#) of people—suddenly had the future of chatbots at their fingertips: an artificial intelligence (AI) we could talk to, and it could talk to us, in an almost indistinguishable-from-human way. OpenAI's DALL-E-2 hit the stage with similar hype, able to generate uncanny digital images from natural language descriptions.

The buzz around AI quickly reached a fever pitch, influencing industries across the board, including the water sector, to get excited, scared, anxious, but most of all interested in artificial intelligence at a whole new level. AI feels more “here” than ever before, and it's changing, fast. Just in the past week, we've had to update this paper to reflect the quick pace of change in AI technology.

If you're in the water sector and you're feeling that heightened AI excitement, you may be wondering:

- ✓ What does the recent AI momentum mean for utilities big and small, and how can you take action?
- ✓ What is AI, and what is it about AI now that makes it relevant to the water sector?

- ✓ What kinds of AI applications exist now in water management, and how might we imagine them in the future?
- ✓ How can utilities take a measured approach to AI in their organizations?

In this paper, four water-sector experts respond to AI's recent momentum and offer their perspectives on the questions above. In an effort to cut through the noise currently swirling about AI, this paper speaks plainly to demystify AI basics and surface pointed considerations for water sector professionals, whether you're an expert, engineer, or manager of a utility of any size.

Ring the bell: It's time for the water sector to converge on AI



Gigi Karmous-Edwards

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It's time to ring the bell and rally the water industry around game-changing AI models and tools, or risk being left behind.

The newest iteration of OpenAI's Large Language Model (LLM) GPT-4 (Generative Pre-trained Transformer 4), recently released after GPT-3, has ushered in a [generative AI revolution](#). GPT-4 is multimodal because it can receive both text and image prompts as input (limited release only). For image inputs, GPT-4 will try to understand the contents of the image. It is uncanny to see the power of this multimodal LLM. The number of parameters in an LLM is often a measure of its size and complexity. This LLM, and ones like it, uses hundreds of billions to trillions of parameters. It also uses a combination of human-supervised and unsupervised training techniques to continually get better and more accurate.

These LLM's are different from the standard language abilities you're used to getting from something like Alexa or Siri. Their advanced ability to work with natural language and images makes them extremely flexible and adaptable.

Not only can they be prompted in plain language to produce human-like written text, these models can also learn new behaviors simply by feeding them new training data and by building upon them for new applications. This is sometimes referred to as last-mile data training of the model for a specific vertical, followed by fine-tuning type training.

While ChatGPT, a chatbot, can generate human-like text from natural-language and image prompts, DALL-E-2 uses the same GPT-4 language model to generate images from natural-language prompts. DALL-E-2 is a neural network-based AI model developed by OpenAI capable of generating high-quality images from textual descriptions. Unlike traditional image generation models that rely on a pre-existing dataset of images, DALL-E-2 uses a combination of deep learning techniques and natural language processing (NLP) to generate original images from textual inputs.



DALL-E-2 generated this original image in a few seconds from the simple plain-language prompt “a 3d pipe network in the shape of a robot.”

This is just the beginning. While these models are capable of only so much complexity at the moment, future, more powerful, sophisticated iterations will eventually be released. GPT-3’s model is based on 175 billion parameters, for example, and while it’s not clear at the time of publication how many parameters GPT-4 has, some predict other LLMs could use up to a [trillion of parameters](#). So while these language models are powerful now, they will only get better, which makes one wonder, what else could they do?

And that’s why the water industry should jump in now, because AI tools will have different impacts depending on the domain they’re developed for and the data they are trained on.

In order for these models to have deep, true application in the water industry, they need industry-specific data and intelligence.

Driving the last mile of data in the water sector

We need to start looking at what we might call “the last mile of data” in the water industry. It’s where we get very specific about data and concepts in our industry, so we can start training these models, and the people using them, to help address the water sector’s unique challenges. Large, diverse, representative data that accurately reflects the water industry is key for these AI to be useful to the industry. We need to teach these models the specialized vocabulary, jargon, relevant data, and concepts that are unique to the water sector.

Because as discussed [here](#), one of the challenges with the accuracy of these newer LLMs is that they’re influenced by their data and training biases. The GPT-4 model, for example, learns from both text data and reinforcement from humans, using a technique called [reinforcement learning from human feedback](#) (RLHF). The technique fine tunes the baseline model by using human feedback to guide the AI’s learning process. However, the data and the people taking part in the training of the model may not be representative of potential end users, and that can affect the kinds of results these models produce.

There are other problems with these models. For example, ChatGPT's model can [hallucinate](#), giving you wrong answers that seem logically sound. It's also not [explainable AI](#), making it something of a black box where we don't understand how it comes to its answers. We need people with industry knowledge to test these models for accuracy and supervise them to ensure the models are attuned to our sector.

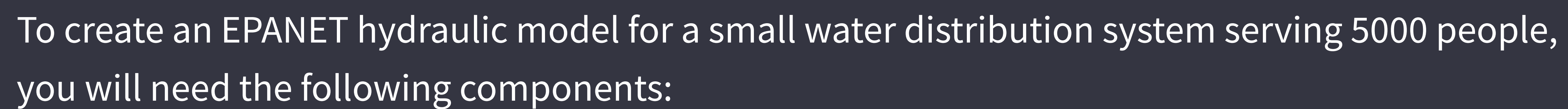
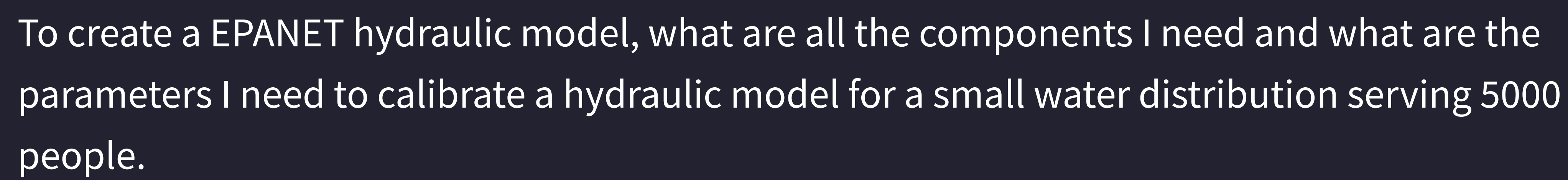
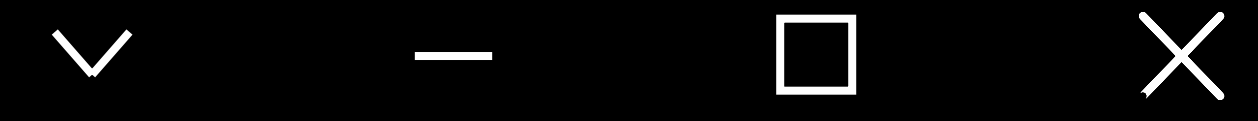
Imagine what could happen if utilities around the world pooled their anonymized hourly meter data to help train and leverage these new AI models for our sector. With an enormous global meter dataset, for example, it may be possible to provide the concept for virtual meters to utilities that may not have the resources to install and deploy AMI meters. Virtual meters could serve as powerful data input for all types of operational analytics, including [digital twins](#). By collaborating on the water sector's last-mile data, utilities could use the power of AI to create a more comprehensive understanding of water usage and patterns, which could inform more effective water management strategies and lead to better outcomes for customers and the environment.

This is an opportunity for everyone in the water sector, from innovative water businesses to utility operators with decades of tacit knowledge (including some who are about to retire and take that knowledge with them), to collaborate together globally and introduce water-industry context, supervision, and data to these models, so innovators in our sector can develop and combine AI solutions customized to the water industry's specific knowledge and goals for the benefit of all utilities, big and small.

Democratizing AI opportunities for utilities of all sizes; not a replacement of work

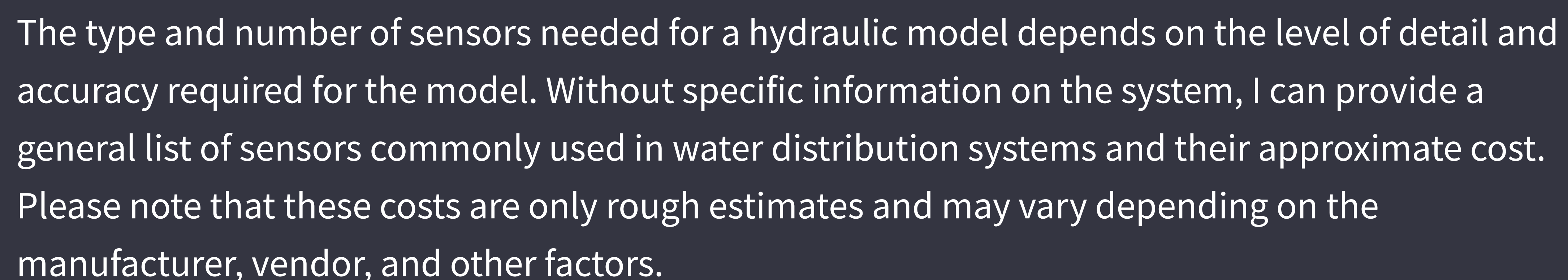
For smaller utilities, or utilities with limited resources, these new developments in AI may feel daunting or out of reach. But actually, these new language models democratize AI technology because people don't have to change their habits as significantly or train on an entirely new program to see benefits. They allow people access to the power of AI without the need for specialized knowledge and skills—all you need is plain language and a bit of creativity to get the AI to produce what you need (prompt engineering could be an interesting focus for the water sector).

The summarization opportunities with these tools alone hold helpful applications in day-to-day work. Imagine feeding all types of utility data into a helpful AI assistant who could then give you plain-language insights about the data in seconds.



Network Data: You will need to collect data on the water distribution network, including pipe diameters, lengths, elevations, and material types, as well as the location and characteristics of all valves, pumps, and other components.

Can you provide more details on exactly what sensors I will need and how many of each for this particular network and place it in a table form where the columns are : Type of sensor, the number of this specific type of sensors needed, and then a column for the approximate cost for one of those sensors?



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Even before analyzing data, these models can help non-experts write a good sample of code to extract relevant information, like average water consumption, different types of pressure readings, or water quality data. It may be able to help our sector pre-process data that hasn't been cleansed yet, or even tell us what needs to happen in order to pre-process data.

You could be an operator in a very small utility that has a lot of expertise and you know you have a leak because you heard it but you need more information about it. These new language models open the door to utility operators using natural language to communicate to the AI model and experiment with the kinds of insights it can give you. Maybe it could suggest data you need in order to understand the problem better, almost like having a data assistant. And in that sense, these AI models aren't a replacement of work but a partnership with AI because they simply don't have the real-world experience and tacit expertise that human beings in the water sector have.

While there's a lot of data already to get started with experimenting and training these models for the water sector, there's also "data as a service" (DAAS – see [SWAN Forum](#) for more on that topic) models starting to emerge to bridge the gap for small utilities who may lack data, resources, capacity, and expertise to collect the data they need to get quality answers from AI.

These new business models take on the responsibility of acquiring the right sensors for the right problems and locations as well as setting up data communications, data cleansing, and analytics so the utility can focus on benefiting from the data. This combination of software and services can bring any small utility on board with the benefits of these technologies very quickly.

The water sector shouldn't be afraid to test and play and experiment with these new AI tools to see how they can work for them. From small towns to megacities, from field staff to executives, utilities can jump in and start playing, innovating, and learning, even with minimal data, how AI can make their jobs easier.

Finally, this is a call to all the sources of deep expertise and knowledge in the water industry—utility operators and managers, engineers, scientists, academics—to contribute their specialized knowledge to machine learning in order to evolve its intelligent outcome and explore how these LLMs can make decision making in the water sector better.

AI Deep Dive: How has AI changed, and what does that mean for the water sector?



Saša Tomić

Digital Water Lead at Burns & McDonnell

If you want to understand the opportunities and barriers to the water industry's use of AI, it's helpful to understand how AI works, how it's recently changed, and where we are now with the technology (and why that matters).

First, “Artificial Intelligence (AI)” is a broad term that encompasses different fields and applications. Some broadly define AI as a computer's ability to mimic human learning and problem solving. Others think of AI as a branch of science at the intersection of computer science and neurology, because you need to understand how humans think to have a computer mimic the human thinking process.

Today, most AIs are **Artificial Narrow Intelligence (ANI)**, also called “Narrow AI”, because they focus solely on solving a specific task or problem. For example, in the water sector we use computer vision, a field of AI that analyzes images and video, dramatically speeding up an existing process where people inspect footage from sewer Close-Circuit Television (CCTV) cameras to identify defects in pipes. Computer vision for this purpose could be considered a narrow AI because it just needs to be able to tell the difference between a clean pipe, a pipe with a defect, or something in a pipe, such as a rag or an animal.

It doesn't have to be too smart; it's intelligence is relatively narrow. And that's more or less where we were until today with AI—most AI applications employ artificial narrow intelligence.



CCTV image showing raccoon in a pipe

We're slowly getting into what's called **Artificial General Intelligence (AGI)**, sometimes referred to as “General AI.” AGI refers to AI systems that are capable of performing a wide range of intellectual tasks that are typically associated with human intelligence, such as reasoning, problem-solving, learning, and perception.

While there has been significant progress in the development of AI systems in recent years, we are only beginning to achieve true AGI. Some argue that chatbots and self-driving autonomous vehicles are AGIs because they're programmed to respond to stimuli, in contrast to narrow AI, which only has to flag something that doesn't fit a pattern and alert a human to intervene.

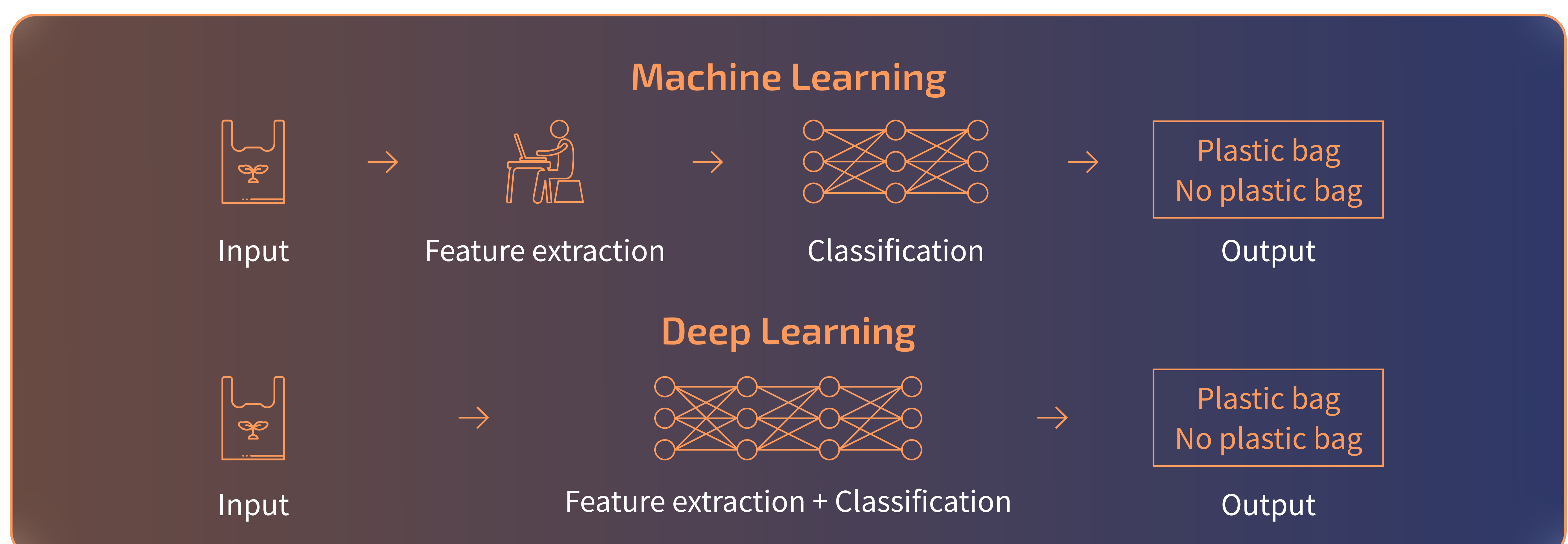
If an autonomous self-driving vehicle, for example, sees a wounded person in the middle of the road, it has to decide to do something, and its decision is mission critical. While driving around the wounded person may be a solution, it is not the best one. At the same time, the AGI wouldn't be an AGI if all it knew how to do was alert someone and ask, what do I do now? It has to recognize and deal with the problem immediately by stopping, swerving out of the way, or some other response. It's vital to the vehicle functioning successfully, and if the AI fails, it adversely affects society.

Artificial Super Intelligence (ASI), also referred to as "Super AI", comes after AGI. This is the kind of AI you may choose to worry about, but you don't have to worry about it now, because we're not near that kind of artificial intelligence.

Super AI is largely a hypothetical future form of artificial intelligence that's transcendental. It surpasses human intelligence, it's self-aware, and it can think on its own. There's no real-world example of super AI, but you can look to Skynet from the beloved Terminator franchise if you want to consider the potential power and risks of a [fictional ASI](#). Again, we're nowhere near this kind of AI, and we may not achieve it (or want to do so).

How does AI learn, and how is AI today different from the past?

We can't talk about AI's progress in the water industry, or at large, without talking about **machine learning**. AI learns through **machine learning**. There are many types of machine learning, but today the most popular is **artificial neural networks (ANN)**, a process that tries to imitate the way humans learn. ANN are layers of linked processing nodes that simulate the way the human brain works. The most basic ANN requires only a *few layers* of processing nodes (small ANN). This kind of AI is considered "non-deep" and it's limited because it *requires human intervention to learn from its mistakes*.



The difference between ML and DL

As an example, in the water sector we use computer vision to drastically speed up an existing process where people inspect CCTV footage from sewer pipes to identify pipe defects. Now, let's say an AI based on a basic ANN model is "in training" to identify defects in pipes. This "non-deep" AI can improve by asking its human supervisor to categorize footage that it cannot categorize, such as a plastic bag in a pipe. It might see a plastic bag, for example, and it will ask its human supervisor, what is this? The human will then code the thing as a "floatable debris." As the AI learns, it may continue to ask its human supervisor for codes when it sees different floatables. But eventually, the AI will see enough floatables that it stops asking for support, because it learned how to recognize a plastic bag without further human intervention.

These days, however, we increasingly have AI that uses more advanced ANN. This is an advanced type of machine learning that's called **deep learning**. And unlike classical machine learning, deep learning *doesn't require human intervention* to learn. It has the ability to improve itself by *learning from its own mistakes*. But here's the thing: deep learning requires vast amounts of training data, processing power, and time to learn in order to produce accurate results. Newer models of sewer AI use deep learning.

The point is, artificial intelligence must first learn by using machine learning, whether the AI is based on a basic ANN model or a deep learning model. And as it learns, it will make mistakes, and learn from its mistakes, with human intervention or without depending on the kind of machine learning the AI employs.

But unlike humans, when an AI makes a mistake and that mistake is corrected, it should never make that same mistake again. And that's important when considering the opportunities the water sector faces with developing and adopting AI solutions.

Because humans get tired. They get sick. They forget. They retire and take their hard-earned experience with them. Humans don't have the ability to transfer the experience to the next "version" of the operator, while an AI does this by default.

New operators will continue to make mistakes in each generation until each generation gains the experience, but AI will not after it learns from its mistakes. And that represents an opportunity in the water sector because if we allow these AI solutions to learn from their mistakes and increasingly get better, that improved knowledge through collaboration with humans can expand to all AI in the water industry and beyond.

Barriers to AI adoption in the water sector

Even though computers are now fast enough and there's more and more data to employ deep learning AI in the water sector that will drastically change how the industry operates, the industry faces unique barriers to adopting new technology. First, the water industry is strongly regulatory driven instead of profit driven. Second, the sector deals with a resource that sustains human life and health and for this reason it is risk averse.

Those two characteristics will need to be overcome to facilitate the adoption of AI in the water sector.

First, regulatory pressures have a strong impact on the technology our sector adopts. For example, hydraulic models used to be very skeletonized, but when the US Environmental Protection Agency (EPA) mandated that utilities monitor chlorine residuals in systems, and gave utilities the option of substituting model results for field observations, suddenly, all-pipes modeling technology exploded, which then also became beneficial in other ways.

We don't know what regulations will emerge that may push the sector towards adopting more AI solutions. For example, there could be requirements for utilities to optimize their massive energy costs. The EPA estimates drinking water and wastewater systems use two percent of overall energy use in the US, generating **45 million tons** of greenhouse gasses annually. Regulations requiring utilities to optimize their energy use may drive the sector to adopt AI technologies faster, because those AI technologies can help solve energy use challenges.

Second, AI can and will make mistakes, and that fact bumps up against the water utility sector's aversion to risk. That means instead of the water sector allowing AI to jump in and make decisions at the speed we've seen with self-driving cars, for example, the sector will likely take a slower approach. It will probably be more like a collaboration between AI and humans in the water sector, beginning with AI making suggestions and providing decision support.

Instead of full self-driving cars, water AI will provide a smooth cruise control that will also provide suggestions to operators that could optimize decision making.

That's where "digital twins" come into play. In the water industry, a digital twin is a digital replica of utility assets and performance, like a water system network. A digital twin can employ machine learning applications, so engineers and operators can test the outcome of decisions before making those decisions in the real world.

Eventually though, our sector will get comfortable with AI suggestions to let it make more and more impactful decisions. We already have sensors turning pumps on and off, for example. With AI, we can be smarter when pump energy is used. And that doesn't necessarily mean utility jobs will disappear. Instead utility operators who lack time and resources will hand off tedious tasks to an AI they trust, so they can better focus on other aspects of their heavy workloads that require human intelligence.

AI applications in water management



Dragan Savic

CEO at KWR Water Research Institute

The future of chatbots: Imagining a more intelligent customer service interface for water customers

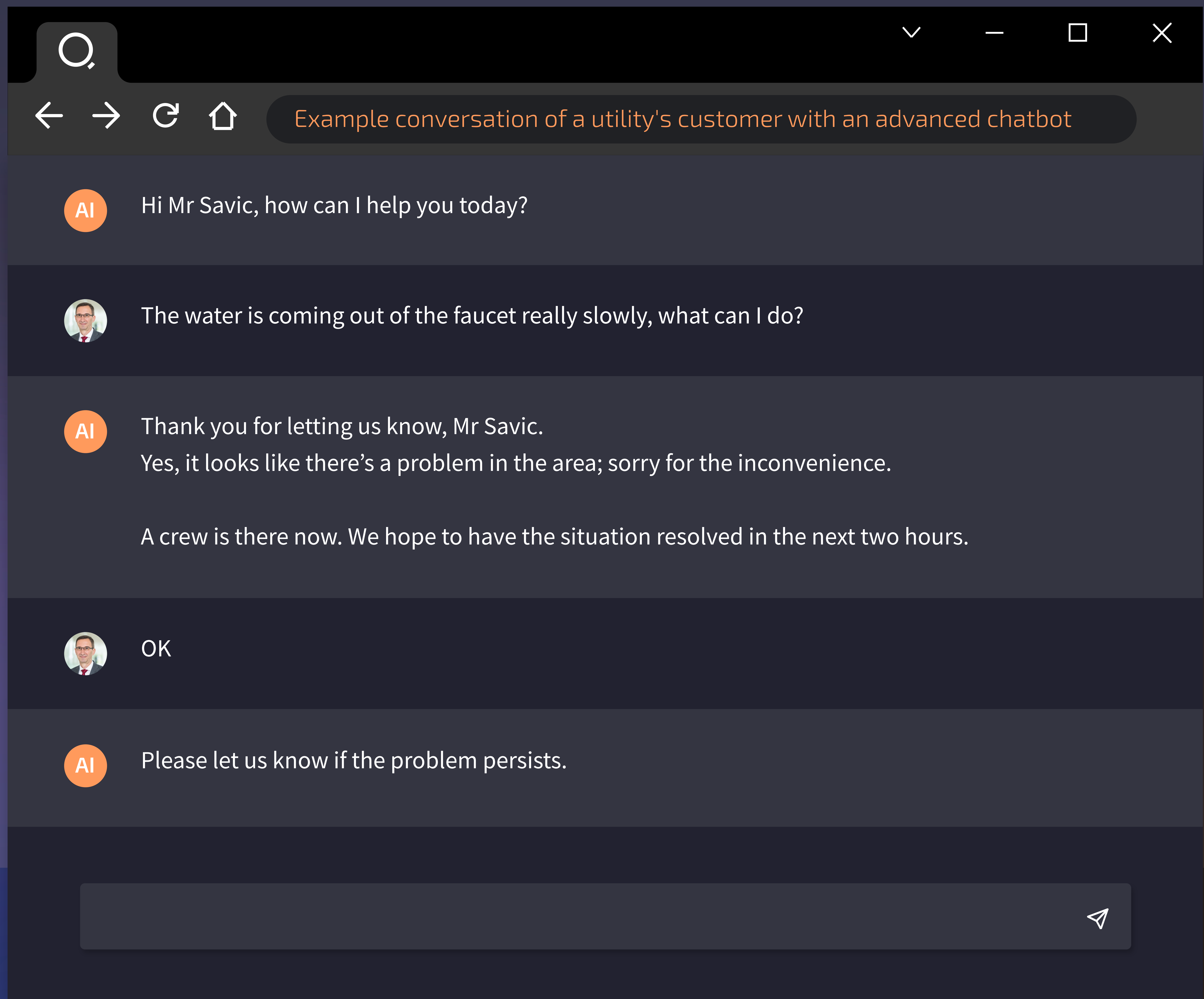
You can see how ChatGPT, [limitations](#) aside, could have helpful applications when it comes to more **intelligent customer service chatbots** in the water sector. Most customer service chatbots today start with computer generated responses to customer questions. When the computer can't answer the customer's question drawing on its available database of preset questions and answers, it will pass the customer onto a human. But these kinds of chatbots often feel very much like you're talking to a computer, and often aren't very helpful.

If something like ChatGPT, however, had access to information from a particular organization like a water company, it could produce much more relevant answers to customer questions by drawing on billing data, customer data, and even the water system's data.

The AI may be able to get much further answering concerns and questions like "Water trickles out of my faucet," "My water is brown," or "Why is my bill so high?" before passing the customer on to a human.

Imagine, for example, a customer complains to an AI-assisted chat with powerful capabilities like ChatGPT that their water is coming slowly out of the faucet (due to low pressure). If it had access to the right data, it could do sentiment analysis to see if there are other reports of problems in the same area. Then it could alert crews and formulate a helpful response, such as, "Yes, we appear to have a problem in that area, and we have a crew heading there. They should be done in two hours and your service will be restored."

That's the type of impact an AI like ChatGPT could have on improving customer service chat bots in the water sector, if it had access to the organization's data and its other limitations, which we listed in the first section of this paper, were resolved.



Evolutionary computation for solving complex water distribution system design problems (in half the time)

One promising area of AI in the water sector is **evolutionary computation** for discovering optimal designs for water distribution systems. This would be especially relevant to planning initiatives in mid-sized water distribution systems, such as cities of 50,000 to 100,000 people. It could be used, for example, for long-term master planning initiatives to optimize future expansion, maintenance, and repair costs.

Evolutionary computation is a subfield of artificial intelligence that solves highly complex problems with too many variables for traditional algorithms. As the name implies, the field is inspired by the fundamentals of natural evolution. Evolutionary computation uses genetic algorithms that draw on principles like inheritance and natural selection — the standard that organisms better suited to their environment will propagate their genetic material and reproduce to become more numerous in their environment.

In the water sector, evolutionary computation solves the problem of testing the almost infinite possibilities there are to achieve an optimal water system design. Even with 100,000 feet of pipes, for example, if you had to change each and every pipe in turn to find the most optimal design in terms of efficiency and cost, there's no computing time in the world available to do that.

It certainly can't be done by a human. Most engineers will only have time to consider a handful of design solutions for a project.

The idea is that the AI can continuously test small changes across large complex systems, adopting the strong solutions and changing the weak ones, until the system reaches what's called "a near optimal solution."

In fact, evolutionary computing has been found to save over half the cost of, and produce better solutions than, manually produced designs. AI based on genetic algorithms can bring us solutions to water distribution system design problems that our sector could not have tackled in the past without AI.

AI for everyday operations: machine learning for fault detection and computer vision

Fault & anomaly detection

One of the most relevant applications of AI in a utility's daily processes is **fault detection**. This would be an AI system that uses machine learning to detect faults in a water system before it causes a problem for the customer. The way it works is the AI learns what is normal based on the historical performance of the system. It recognizes normal patterns based on time of day, temperature, season, and other variables, and then it makes a prediction for what will happen next. If the prediction is of equal or similar value to what it would expect, then there's no problem. But if there is a large discrepancy, then it can alert operators.

For example, imagine a pipe bursts somewhere in your distribution system in the middle of the night, and your AI system detects a problem. It could then alert a crew to go and repair it before it causes problems for the customer. In the morning, the customer turns on the shower without even knowing there was a problem.

Combine this kind of AI-driven analysis and alert system with a generative natural language model like ChatGPT, and utilities with limited resources, especially smaller utilities who may not have the in-house analytics department that a larger utility often has, could see a huge benefit.

We see this kind of machine learning and natural language processing capabilities emerging in the water management industry with tools like [Qatium](#), for example, which has a digital assistant “Q” that provides alerts for anomalies like abnormal pressure zones, tank levels, flows, and other important daily operations.

Computer vision

As discussed earlier, a deep learning AI application we increasingly see in the water sector today is **computer vision**. Computer vision uses deep learning to analyze video and photographs to detect anomalies, leaks, and faults much faster and with [more accuracy](#) than traditionally human-manned analysis.

Deep learning AI is extremely good, and fast, at learning visual characteristics of pipes. It can characterize imperfections in a methodical way that humans simply don't have the bandwidth to do. Image-based deep learning can draw on its immense dataset to be able to identify whether, for example, the footage is showing an accumulation of debris or whether it's actually a break or slippage in a pipe connection. Even if humans didn't make mistakes, after two or three hours of looking at this kind of footage, it loses all meaning. But deep machine learning doesn't have that problem, making it a very good application for Closed-Circuit Television (CCTV) data. There are even recent applications where image-based deep learning models use CCTV footage to analyze the density of raindrops to recognize the [intensity of rainfall](#), which has important implications for quick flood management responses.

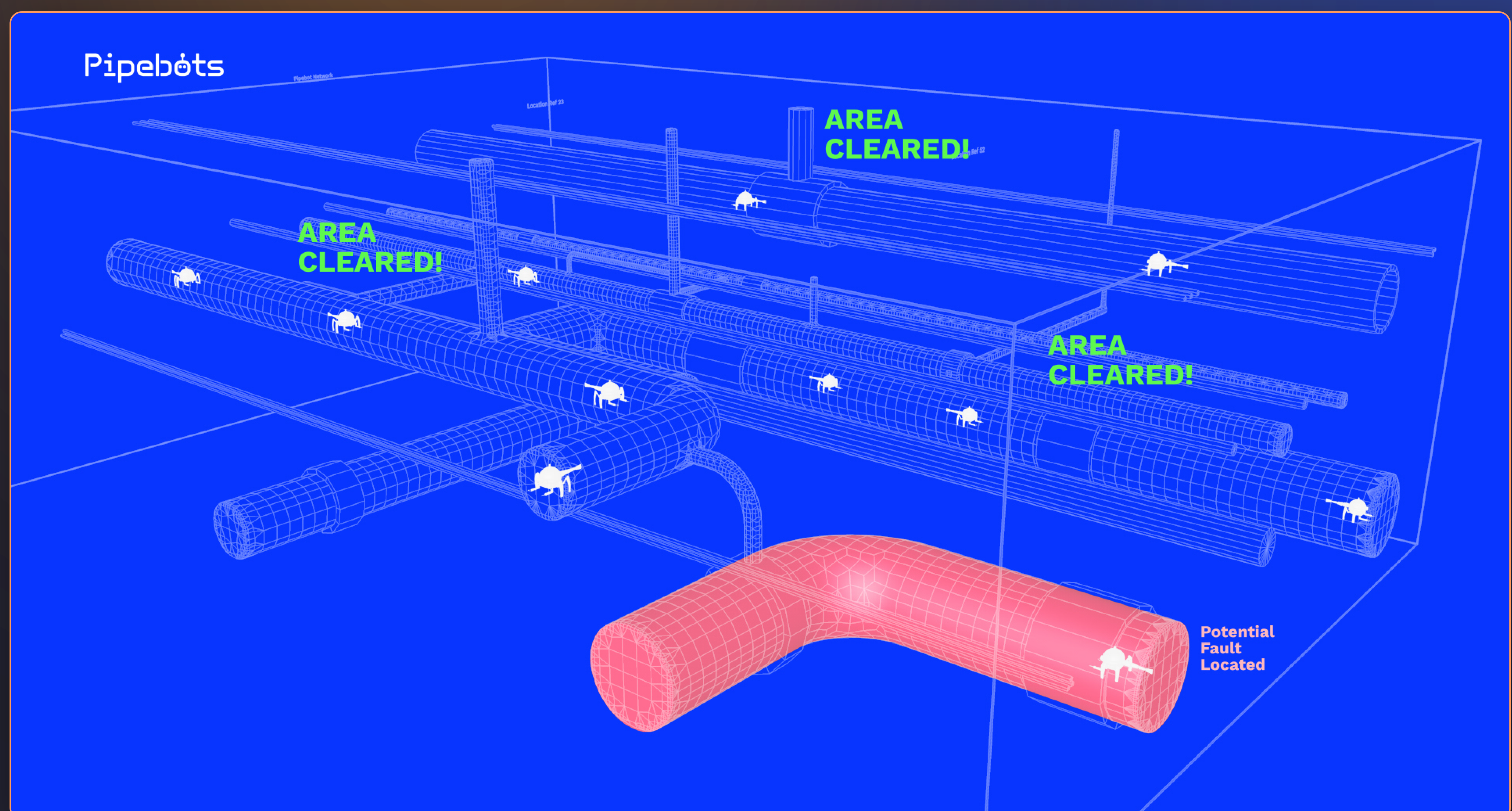
What's next for AI applications in the water sector?

Robotics have a clear future in the water management industry. Our industry deals with infrastructure that is difficult and sometimes dangerous to monitor, access, inspect, and understand by virtue of it being buried underground. And while robots play a key role in other industries where it's too difficult, dangerous, or disruptive for humans to travel to collect data, the water sector hasn't successfully fully leveraged robotics yet.

Still, we've seen some movements towards robotics in the water industry. For example, there have been devices developed that people drop into pipes to collect data for leak detection. The devices don't stay in the pipes; they're dropped in at one location and then picked up at another location, so the data can be harvested and analyzed.

But in the future, we should see more autonomous robots that stay in a water system indefinitely, crawling through a pipe network and continuously collecting and sending data to be analyzed with AI analytics for information on a network.

As mentioned earlier, advancements in water sector AI are constrained because, one, we're not a high-profit industry and, two, we're risk averse because our water systems are essential to human health. So even though robotics and AI are a logical future for water management solutions, our progress in that direction is slower than in other industries. Still, we should be optimistic about the exciting potential applications of future AI solutions in our sector.



Pipebots aim to revolutionize buried pipe infrastructure management with the development of micro-robots, designed to work in underground pipe networks.

Is AI the right fit for your utility? How utilities can approach new AI technologies effectively



Paul Fleming

Founder, WaterValue LLC, and water and climate tech advisor

Problem identification

AI often gets imbued with the sense that it's going to solve everything and work everywhere. And while optimism about AI's potential in the water sector is important, it's best weighed with a healthy dose of discretion, and a focus on the unique goals and priorities of individual utilities. If utilities are interested in AI, it's important to learn more about AI applications and carefully consider the problems you need to solve, so when vendors come to your organizations with big AI promises, you're ready to evaluate whether it's a solution that truly aligns with your goals.

The deployment of any AI solution should be preceded by a clear understanding of the problem or opportunity you have and an assessment of the best potential applications of a given AI solution.

In other words, start with identifying your problem first, then work backwards to the appropriate tool, as opposed to starting with a solution in search of a problem.

There are many tools available to the water sector that use machine learning to help utilities solve problems, and we've highlighted some of those applications above. As the excitement around ChatGPT continues, more applications will be developed that are relevant to the water utility sector. Here are some considerations you may want to keep in mind.

Data considerations

One of a utility's greatest assets is its data. A utility's data can be incredibly diverse and rich but also spotty with gaps and of uneven quality while also spread out across an organization. There may be customer data, usage rates, service interruption data, financial data, weather data, social data and then of course the many data about network behavior and network assets. The problem is, these data are often siloed between business units, especially in larger organizations. Typically, organizations aren't fully leveraging their data across business units, a common problem across many industries.

There can be significant opportunities from viewing data as an asset and putting it to work as an *asset system* to generate insights that can be leveraged to improve decision making and customer experience. Getting to the point where the data can be the engine that feeds and drives the AI will likely require significant action on data hygiene and data preparation.

Cultural fit and change management

The best ideas can die on the vine if they're not properly nested within the dynamics of the organizational culture, and that applies to the adoption of AI tools as well. Any kind of big change, especially technological change, has a change management implication to it that the water sector needs to acknowledge and keep in mind.

Technological change in an organization can fail and become exceedingly costly for a number of reasons, like an organization not clearly identifying and communicating why a new technology is needed and creating a clear roadmap for measuring its success. Poor change management can also exacerbate employee resistance to change, especially with AI-enabled tools that often bring up fears around the threat of automation and job elimination in the workforce.

But while new technology can repel people, it can also attract people. Utilities may want to consider their future in the wake of the "Silver Tsunami," an aging demographic and a wave of retiring workers, and whether a new generation of talent will want and expect AI at work.

Do water organizations that resist AI technology risk not attracting the new talent that the water sector will unequivocally need? It's still perhaps up for debate whether younger generations will choose organizations that embrace AI over others that keep it at arms length. The point is, the message a utility conveys to both its existing and future workforce regarding its utilization of emergent technologies is something to consider.

Small utilities may be more agile

While AI may seem more daunting for small utilities, smaller utilities could have the advantage when it comes to adopting AI tools faster than larger organizations. Simply by virtue of being small, there could be less siloed data, and fewer people can mean easier left-to-right visibility into the organization's workings, which would make change management less of an undertaking.

In other words, while larger utilities may naturally have more data and analytics to feed and drive AI tools, they could be less agile when it comes to actually mobilizing their organization to adopt new technology. A smaller utility, even if they have a data gap, could be in a better position to bridge any those gaps quickly due to less red tape and less people to align towards the desired technology change.

Nevertheless, utilities of all sizes should approach this new era of artificial intelligence with a sharp eye on the problems they wish to solve, along with related considerations, as they explore options for selecting and deploying relevant AI solutions.

Final Remarks



Q

Your digital assistant

Hi there! I'm Q, your digital assistant.
Thank you for reading our paper on AI & water management.
@Experts — any final remarks to leave our readers with?



Gigi Karmous-Edwards

Water Sector Digital Twin Expert & Consultant, Karmous Edwards Consulting LLC

The AI revolution is currently upon us, and language models like ChatGPT and other LLMs are advancing at an unprecedented pace. As such, it is essential that the global water sector collaborate to help train these models on last-mile data, specifically related to water operations and sustainability. The purpose of last-mile training is to improve the accuracy and relevance of the model for a specific task or domain. This effort requires the collection and curation of large, accurate, and consistent datasets, which can be used to develop question-answer pairs to train LLMs. One can take this a step further and fine-tune the model to very specific data sets to make it more powerful in a more narrow area of expertise.

In addition, last-mile training of LLMs has the potential to democratize access to knowledge and understanding of water-related issues within the community. By providing a tool that can be used by anyone capable of using human language, regardless of their technical expertise, last-mile trained LLMs can help to bridge the gap between technical experts and the wider community, and empower personnel at all levels to access critical information related to water management and sustainability. This can lead to more informed decision-making and more effective management of water resources, ultimately benefiting communities and ecosystems alike.



Saša Tomić

Digital Water Lead at Burns & McDonnell

Our industry faces numerous negative trends: increased water demand with shrinking supply, climate change, regulatory pressures, experienced operators retiring, to name just a few. However, another, often-ignored trend promises to mitigate the impact of these issues, and that is digital transformation.

In the last thirty years, we moved from paper maps and hand calculators to GIS and computer models. In the next two to five years, digital twins using predictive models and artificial intelligence will change how we make decisions in small and large water utilities. In the future, Digital twins, powered by AI, will collaborate with utility operators to deliver improved utility management and operation.



Dragan Savic

CEO at KWR Water Research Institute

The water industry is facing enormous challenges today, and those challenges will only multiply with climate change, population change, and sustainability goals of the future. Artificial intelligence will be one of the tools in the armory of water resource managers who will be tackling these challenges head-on. One of the key advancements, and the way we will accelerate change in the water industry of the future, is by leveraging AI to integrate and utilize multiple sources of data, because until now we have focused too heavily on individual data streams, limiting our ability for richer insights AI can give us.



Paul Fleming

Founder at WaterValue LLC, and Water, Climate & Tech Advisor

AI has the potential to radically transform large swaths of society, including the water utility sector. To harness this transformation, the utility sector needs to assess what types of challenges and opportunities best lend themselves to AI solutions. Such an assessment could be done collaboratively, across the utility sector, to establish a roadmap to guide utilities towards the most relevant and promising paths. Invariably, any path will likely necessitate that utilities ready their data assets and data systems, as well as their employees and organizations, in order to be able to leverage and adopt, with minimal negative disruption, AI solutions.

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