



Machine Learning and AI – Enhancing Water Asset Management

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AI and water – we've been here for a while!

- AI is often seen as the next technological step to achieve the digital water agency.
- In fact, AI is not new in water - machine learning and other precursors to AI have been used to great effect for (at least) 10 years, in leak detection, pipe failure prediction, and pump optimization.
- But for all its promise, AI is not a silver bullet.
- This presentation presents a balanced view of AI and identifies a possible way forward.

Digital Water Transformation: The Promise of Artificial Intelligence

HOW ARTIFICIAL INTELLIGENCE IS TRANSFORMING THE WATER SECTOR

How Artificial Intelligence is Reshaping the Water Sector

MACHINE LEARNING MAKES WATER SMARTER

Waking up to AI in the water industry

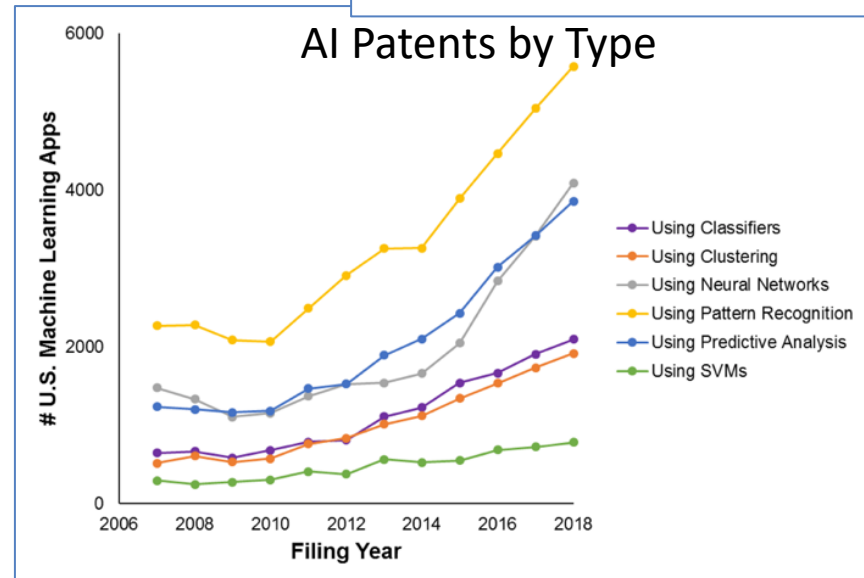
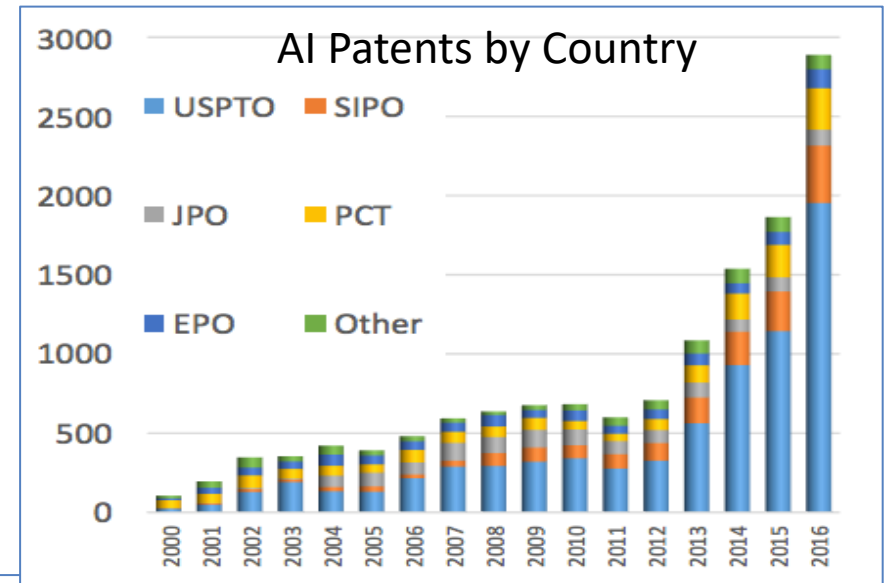
AI and machine learning are flowing into the water industry

New technologies are improving productivity, efficiency, safety and customer satisfaction.

Devil's advocacy - AI technology is evolving so fast, the industry is technologically unstable just now.

- Even by the standards of the last 25 years, the rate of change in AI is astounding.
- Competitive advantage for any vendor majoring in AI will last months (if that!).
- This is *good*: prices will come down, new options will abound.
- This is *bad*: AI strategies may not age well and strategic vendors may have disappeared just when you need them!
- Vendors will need something beyond just AI to make their “secret sauce”.
- Utilities need a better defined goal than just “AI for its own sake”.

<https://voxeu.org/article/trends-artificial-intelligence-technology-invention>



<https://www.ipwatchdog.com/2019/05/14/patent-trends-study-part-ten-artificial-intelligence-industry/id=109189/>

Devil's advocacy (2) - the actual role of AI may be hard to pin down...

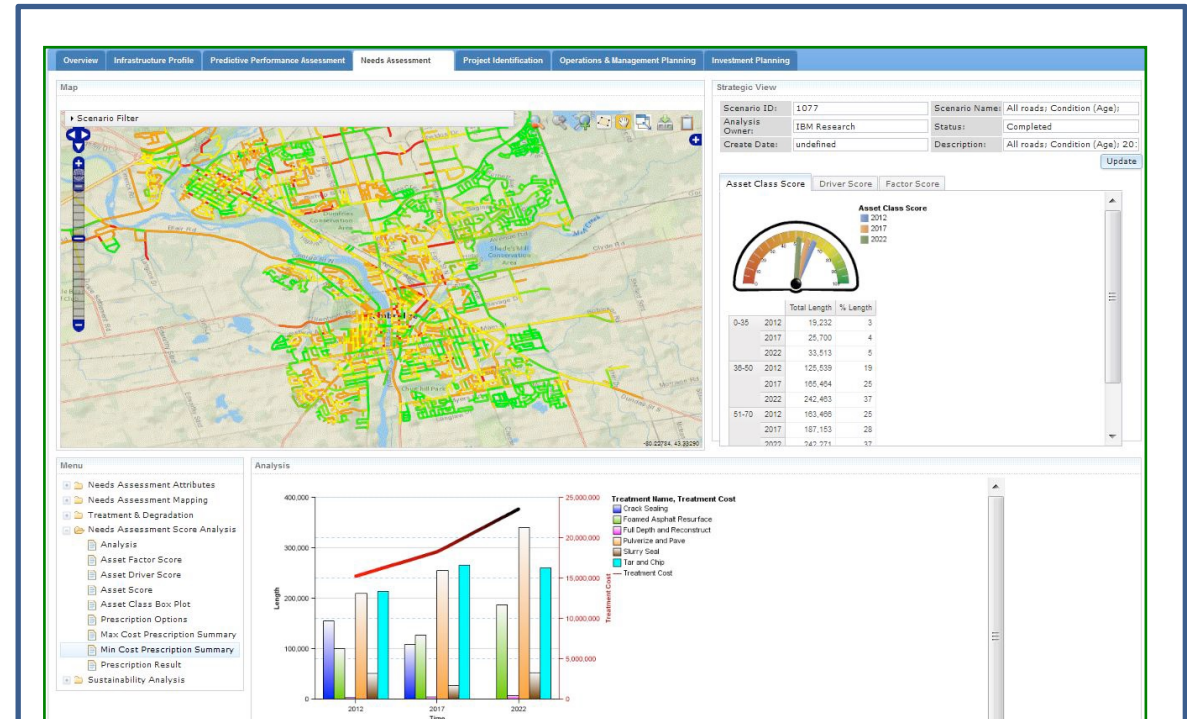
- Real example – treatment optimization tool uses artificial neural networks to optimize activities based on predicted risk to compliance, addressing:
 - Tough-to-predict influent volumes and quality;
 - Operators guessing cycle times and chemical doses based on experience;
- It generates major savings from reduced energy, labor and chemical costs
- So – “Strike 1” for AI?



- >80% of the benefits come from a deterministic model based on the chemical physics of each step of the process, common from client to client.
 - Model is linked to process twin of each treatment plant.
 - AI is used only to calibrate in each case.
- *So is this a strike for AI...or for good old-fashioned chemical engineering?*

Devil's advocacy (3)- AI may just be a “better mousetrap”

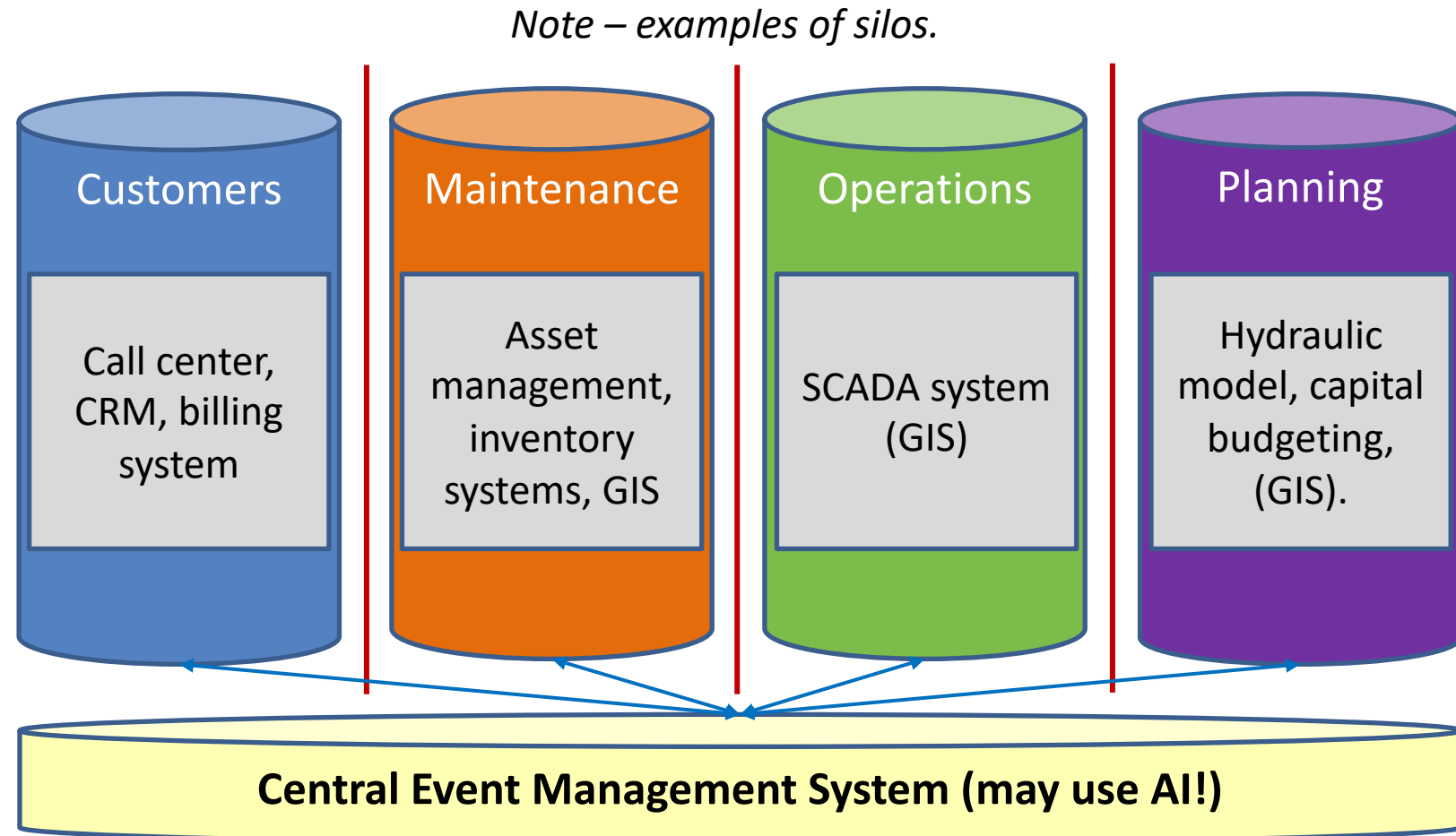
- Benefits may be limited by external factors that AI will not overcome. For example:
 - Once NRW levels satisfy regulators, economics apply: the cost of detection and digging up the street vs the price of water. AI won't change this.
- AI may not be needed to hit statutory performance levels at reasonable cost.
 - Or, benefits of newer AI may have been pre-empted by earlier machine learning or rules-based expert systems.
- In at least some cases, the current wave of AI represents just “better mousetraps” ...
 - ...when the water sector often still isn't using the original mousetrap!



Maximo-based tool from 2010 that predicts – very reliably – which pipes are at risk of breaking next year, for input to capital budgeting. Uses statistical clustering and machine learning – early forms of AI. Enabled 18% reduction in cost at same level of reliability.

Devil's advocacy (4)- the real value of AI may not even be the AI part!

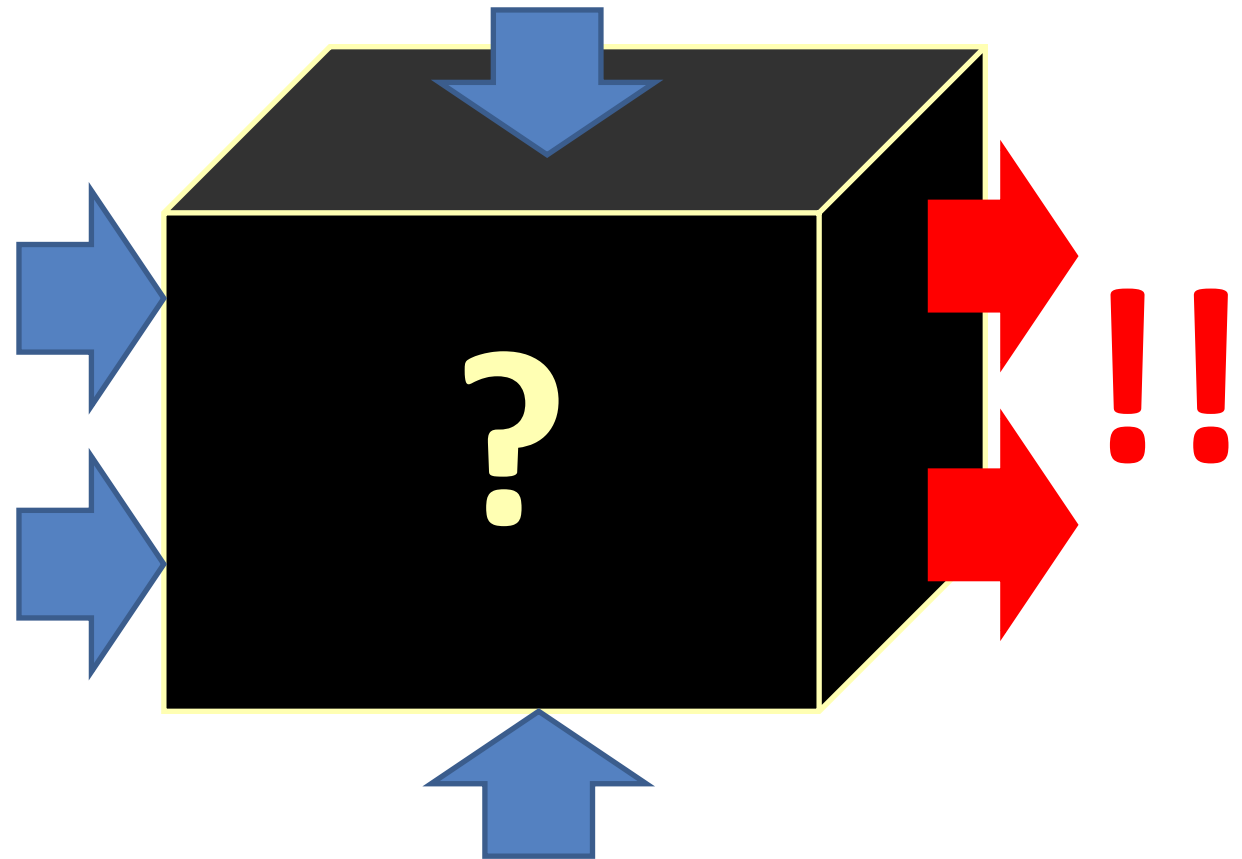
- AI uses data from historical and extra-utility sources (weather, soil types...), and from IOT devices.
- But its real value may lie in causing that data to be integrated in the first place, and enabling functional silos to collaborate better.
- Example: vendors of CEM systems (eg Takadu, Trimble). They use AI but their *real* value lies in creating “a single version of the truth” to which all stakeholders contribute and from which they all benefit.
- AI helps, for example in identifying risks or event response methods, but it's hardly the whole point!



BUT – once the data has been integrated, it becomes much easier to implement AI!

Devil's advocacy (5)- AI without the right data may subtract value

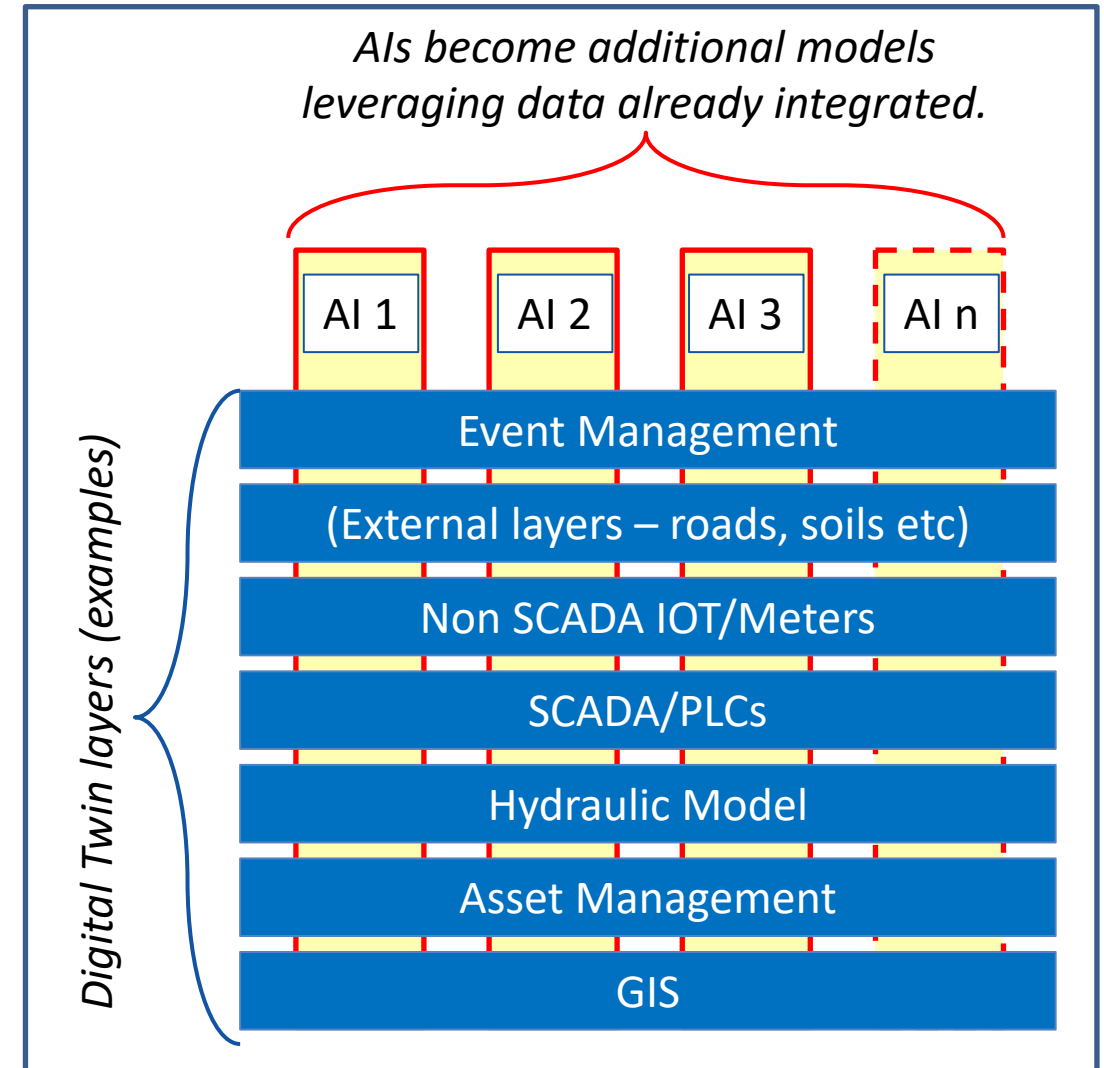
- AI is absolutely dependent on data selection and data quality: “garbage in, garbage out”, but on steroids!
- Many AIs are “black boxes” – it isn’t visible why they produce a given answer.
 - Deep learning especially has this issue, but it isn’t alone.
- In services with public accountability, or where safety issues arise, that is a major problem!
- This suggests that successful, less risky AI applications will tend to be incremental add-ons to current practice.
 - Beware moonshots!**



**See, eg: <https://radiofreemobile.com/2019/09/05/artificial-intelligence-dull-delivers/>

Digital twins – a platform for AI and a way to reduce AI risks...?

- Digital twins (DTs) pre-integrate core layers of asset data and:
 - Drive data quality and cleanliness (perhaps with AIs to capture updates from work orders etc);
 - Enable co-working benefits across the utility;
 - Enable non-AI solutions such as the water treatment example earlier, or continuous hydraulic model/ SCADA comparisons;
 - Become the platform for the digital utility.
- New AIs build on data already integrated, enabling smaller, faster change increments. Examples:
 - Energy optimization AIs use the same asset, SCADA and hydraulic data as predictive maintenance AIs;
 - Leak detection AIs use the same hydraulic and SCADA data as energy optimization.





Thank You!

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