ARE SELF-REGULATING WATER SYSTEMS ACHIEVABLE THROUGH MACHINE LEARNING?

WATERBOARDS ARE PRESSED TO DO MORE WITH SHRINKING RESOURCES AND FUNDS. THEY MUST DEPLOY 'SMART SOLUTIONS' IN THEIR DAILY PROCESSES TO ACHIEVE HIGHER EFFICIENCY LEVELS.

Government organisations today are pressed to do more with ever shrinking resources and funds. The 22 waterboards in the Netherlands are no exception. With large areas to be managed by limited staff, waterboards simply must pick their priorities for field activities. However, this does not mean that the desired results will not be achieved. Rather it means that waterboards must use 'smart solutions' in their day-to-day processes to achieve higher efficiency levels.

The goals of waterboards are simple - manage infrastructure such as dams and dykes; keep water systems clear and flowing; and balance flooding and drought situations. Since all their assets are on the field (location), it is but natural for waterboards to rely on imagery for monitoring and decision making (intelligence). Location-intelligence hence forms the bedrock for all field operations.

We stand on the brink of the fourth industrial revolution which is fundamentally different from the previous three. The underlying basis for the fourth industrial revolution lies in rapidly evolving communication and connectivity. Breakthroughs in artificial intelligence, internet-of-things and robotics (amongst others) affect us in our daily lives, but their potential is not fully understood yet. [1]

Adapting Machine Learning in daily work processes at waterboards can incite a wide range of possibilities. Integrating the concept of Machine Learning into imagery processing technology holds the key to achieving actionable insights.

Whether it is about identifying locations and nature of obstructions, illegal excavations/constructions, or monitoring ingrowth and water storage levels, 'smart'

satellite imagery can improve accuracy and efficiency.

Tjip van Dale

Senior Geospatial Solutions Specialist at IMAGEM

"Integration of analytical tools with smart Machine Learning algorithms offers new possibilities for detecting phenomena on the earth's surface using satellite/remote sensing data. Users do not need to specify analysis criteria themselves but simply define what they are looking for; and relate this to specific locations in the satellite data where the phenomena are present. The smart system learns to distinguish 'what to look for' (and what not to) and generates criteria itself (i.e. machine-intellect) to produce accurate results for future classifications. Simply put, Machine Learning contributes to lowering the threshold for using satellite data in spatial issues. And this is not limited to just waterboards, the application areas of harnessing machine 'intellect' are indeed limitless."

A recent example in the Netherlands of this futuristic solution is at a waterboard – Waterschap Drents Overijsselse Delta (WDO Delta).

Let's have a look: Each year in autumn, about 60 staff members from WDO Delta spend an entire week checking for obstructions in water flow. The blockages in waterways are usually formed by

vegetation and/or other pollutants. Usually this task needs a couple iterations – there is the initial check, and a follow-up for complex situations. The process is painstakingly labour- and time-intensive that hampers staff availability for other activities.

Last year (2018), the gargantuan nature of this annual activity piqued the interest of Jeroen Waanders, Innovation Advisor at WDO Delta. He wanted to drastically reduce the frequency of field visits by extracting highly accurate insights from satellite imagery. This is where the need for embedding artificial intelligence came in.
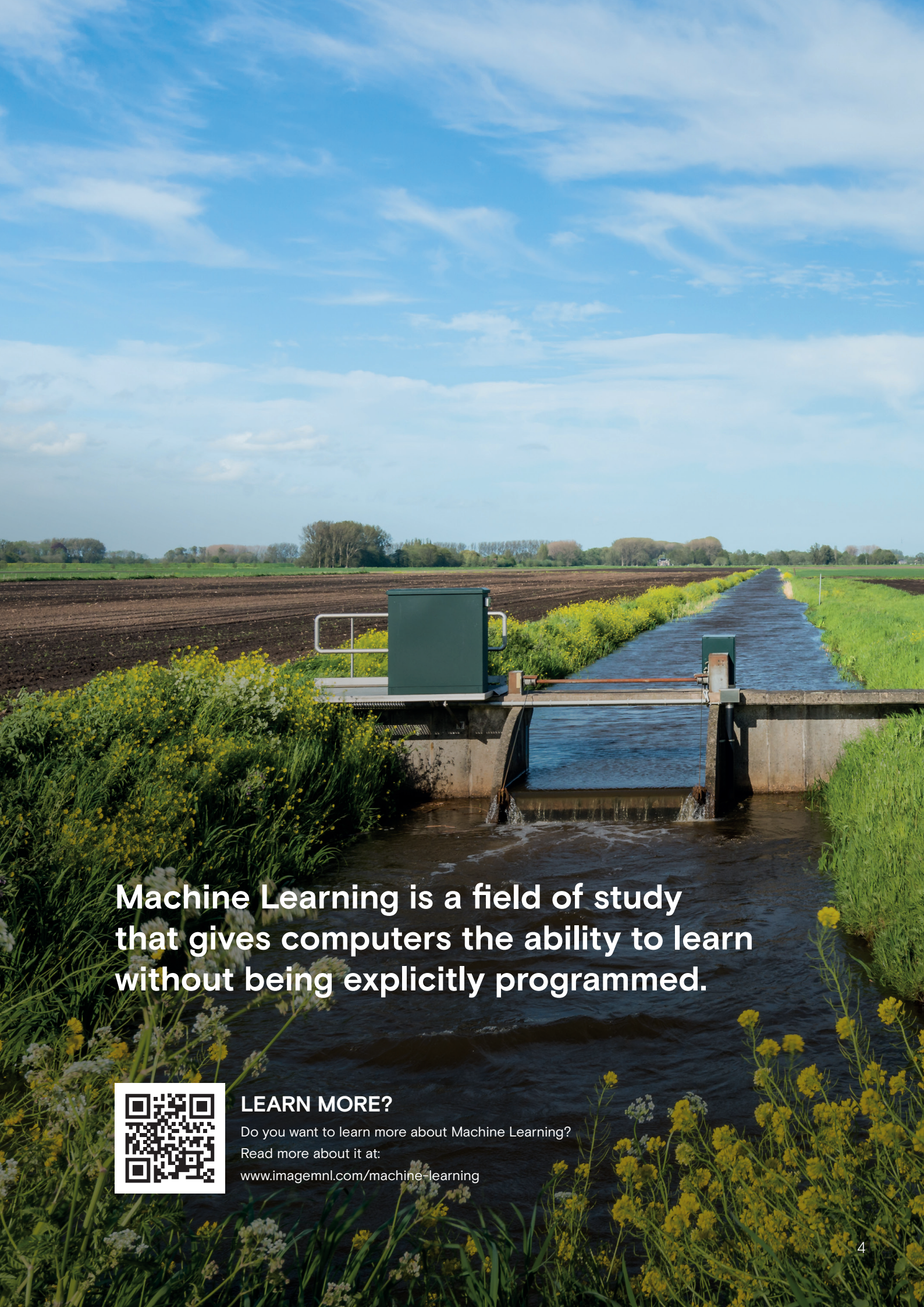
Jeroen Waanders

Information Advisor at WDO Delta

"We have been partnering with IMAGEM for many years now. They think along with us in finding solutions that generate added value for us. This project affirms that technological developments really do offer possibilities to support organisational goals in an innovative way, as well as absorb the consequences of staff turnover,"

Jeroen kick-started a living-lab to integrate Machine Learning into the existing imagery processing technology with IMAGEM; who have been working with the waterboard for creating innovative location-intelligence solutions using Hexagon Geospatial technology. In cooperation with CGI, IMAGEM developed a survey model based on Machine Learning that could be applied to satellite imagery.

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Machine Learning is a field of study that gives computers the ability to learn without being explicitly programmed.
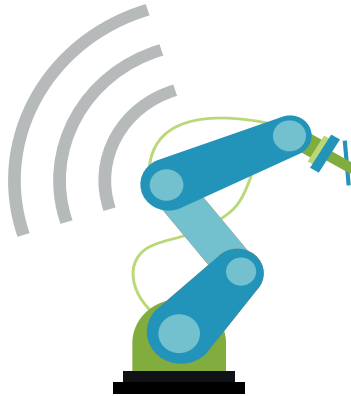
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Traditional methods of imagery comparison could identify approximately 40% of blockages accurately. With the application of Machine Learning, where the model was trained to identify specific situations, ensured that a recognition rate of around 98% was achieved in just a few months. WDO Delta pioneered a breakthrough approach to regulating their water systems by simply eliminating the need for relentless site visits.

Patrick de Groot

Sales Director at IMAGEM

"Application of Machine Learning enables waterboards such as WDO Delta to create data-driven strategies and tasks for risk management. Instead of spending time to looking for the problems, they can now focus on solving the problem.

Evidence-based deployment of manpower and resources is much more effective and leads to faster response times."

Their staff will longer be required to check each waterway physically for blockages that hamper waterflow. Rather the 'smart' solution will identify areas that need to be physically checked. In a controlled test-environment, Jeroen Waanders with support from IMAGEM and CGI has attained a self-regulating water system – a first of its kind in the Netherlands.

The next challenge for WDO Delta is to move this concept from the living-lab into their live environment. If near-real time data (higher frequency of satellite imagery) is added to this equation, it would ensure continuous monitoring and evidence-based decision making. WDO Delta plans to do so in the autumn of 2019.

While the ripple effect caused by this disruptive solution is yet to be seen, this achievement is only the tip of the iceberg.

The possibilities with Machine Learning are endless, when integrated into powerful location-intelligence solutions. You are now in the fourth industrial revolution, don't work for your data, make your data work for you. ■

Yashita Arora
Marketing Director,
IMAGEM