YOU MAKE GEOSPATIAL MATTER

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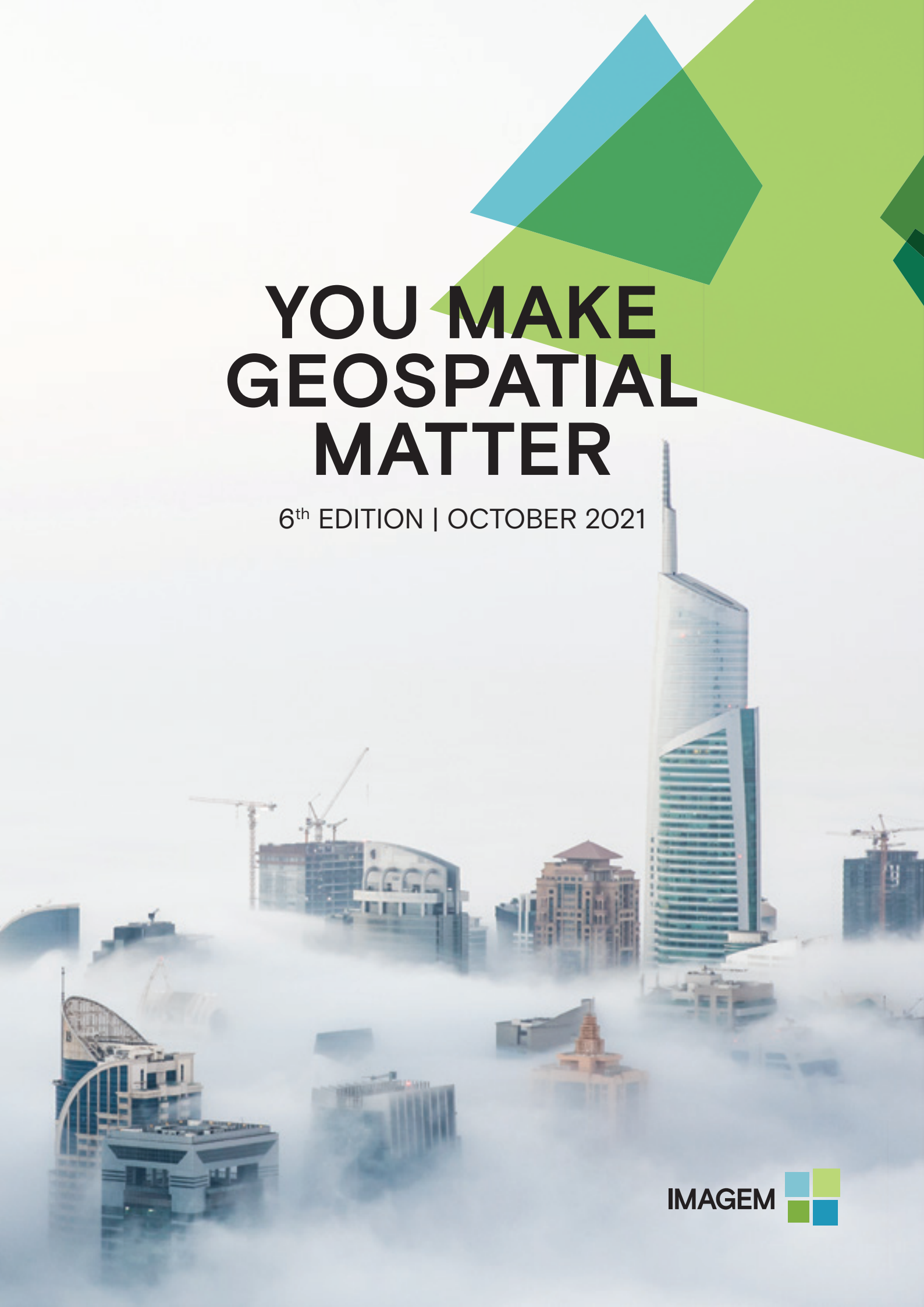

IMAGEM

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IN THIS EDITION

FROM DATA DRIVEN TO CONTEXT AWARE

Wouter Brokx

CEO at IMAGEM

If you consider how complex the world around us is, it is remarkable how well people can understand and translate problems into solutions. But does that also count for our systems? Systems mostly look at a set of predetermined rules. Systems struggle a lot with anything that doesn't fit within one of these predetermined rules. If only our systems could think and act as us humans do, that would make our life so much simpler. We believe it is possible. Is the sky the limit, or will we keep dreaming?

We humans are very aware of our environment. To understand what happens around us, we sort our world into smaller blocks without putting in a lot of thought. We go to school to learn and collect validated information that we record as knowledge that we can use later. We learn scientific thinking in processes, with which we can connect these small blocks. We also learn to reason. This helps us to explain existing knowledge and to structure events so we can explain these, come to conclusions, or make predictions.

Humans and nature cannot be predicted

Because the number of blocks and data is ever increasing, we use computer to help us. By automating the data processing, we can understand much more from our environment. It would be quite handy to pour our world in a predetermined model, but this is almost impossible. To create a model, you need to know in advance what could possibly happen and consider all possible situations within the model. With 'possible situations' we mean 'known situations' or situations that we can predict based on a particular reasoning. And that's kicker because nature and humans are erratic and impossible to predict.

Allowance affair 'good' example

The computer systems that we have created thus far to help us are made for automation and optimizing the processing of data in these blocks. The approach, architecture, and implementation of the current fourth generation technology is aimed at optimizing business processes. That works fine with simple and straightforward processes, but mostly not for digital services. Everywhere that includes personal advice to humans we see things go wrong. People like to have care and attention and not just efficient automated processes. In addition, it goes wrong when unexpected processes happen. There are sadly more than enough examples. The allowance affair is such an example of where a process treats humans as a number. An emotionless computer process has led to an automated decision that is completely wrong. This has led to massive consequences for those involved and that's mostly because they weren't listened to.

Focus on the important things

Did you have a business lunch or team meeting in a restaurant the last couple of weeks? We're finally able to do so. You probably noticed that during a lunch meeting in a restaurant it's not particularly quiet. Many tables are occupied, and everyone is in a similar way busy with their own conversations and questions. It's a cacophony of sound, voices, cutlery, waiters that pass by. All these signals are too many to process. We humans are brilliantly trained to filter this out. From everything that we perceive we can focus on just those things from the context to achieve what is relevant to us. We focus on those seated at the table with us, because that is relevant within the context of our goal. In order not to starve, we focus for a short time on the waiter to relay our order. What can we learn from this to improve our digital services?

Prevent an 'information overload'

Focused listening is important with this. It requires that you clearly envision which targets you want to achieve. If you take in all information and data without any filter, it could easily lead to an 'information overload'. That's why filtering helps, and we do this from targets. We filter based on every scale level: In the restaurant on sound, in the conversation on topic and in the sentence on words that help us to understand which image the other is trying to convey. Curiosity to the contents of the conversation helps us to find and build the right context and have an opinion about it.

The scale model of this age

In the past we made scale models of future scenarios. The main advantage of a scale model was that you could walk around it with multiple people and that everyone from their own perspective could form their opinion. Digital twins are the scale models of this age. They not only bring all knowledge accurately with each other in one topic, like underground plumbing and buildings. They are also very accurate and help to visualize effects like shadows. The main advantage of a digital twin is that everyone can look at it from their own expertise, but from one common information position.

From reactive to adaptive, sounds so logical

When we form an opinion, it demands discipline to answer instead of reacting. An answer is a form of reacting, but it involves the result of the reacting in the reply. Plainly it means; think before you say or act. Do not respond data driven, but context aware. Because when we are aware of our environment, ourselves, and common goals, then we can reason from our context about a fitting and

proportional answer. When a child, for example, asks what kind of constellations it sees, it is requesting a knowledge transfer, but isn't expecting a lengthy explanation of the origins of the universe. That is, in this case, not proportional. This may sound logical, but the principle of listening instead of doing is the difference between adaptive acting and reactive acting.

Next generation IT

Speaking of adaptive, in our private life we are more than used to it. People want to have customized experiences and want to participate. Just look at the massive growth of apps that allow people to always, instantly, and everywhere activate custom personalized services, like Uber. Or apps where people can participate and talk about relevant issues to them, like Instagram and LinkedIn. Those services are based on mobile internet computing, and this is when we talk about the fifth-generation technology. The current third and fourth generation IT-systems from the government, commercial services providers and most companies don't work that way. They are not designed for participation and personalized services based on mobile internet computing, because they are not built that way. The changing of those systems is going to be necessary quickly, and the transformation is a paradigm shift. It will require a completely different approach, a new way of thinking, and a lot of courage. Because transformation is difficult and painful. The current situation, however, also increasingly hurts and delay will make the pain last longer.

Build with us

What is the conclusion to our story? That for a good digital service we need systems in the next generation that are adaptive through more focused listening and empathically and understanding through context awareness. We at IMAGEM believe that transformation primarily isn't about technology, but about people. But adaptive technology is a necessary support and the only way to provide personalized services in an ever-changing complex world. We work on technology for empathic organizations and an environment of cooperation between humans and machine that can strengthen each other by focusing on their respective strengths. That helps organizations to utilize the full potential of their workforce. We are building on our dream where the government and corporations help transform towards the fifth-generation technology. That is how adaptive aware organizations are created that can make the best decisions based on context rich facts. This dream is something we would like to build together with you. As far as we are concerned the sky is the limit!

AIR FORCE LISTENS WHERE IT CAN FLY WITH LUIK DASHBOARD

By displaying flight data in a clear dashboard, the Air Force knows where they can practice and maintain good communication with residents in the area.

Managing the Dutch airspace is a challenge. The Air Force plays an important and supportive role in this. With the help of fighter planes and attack helicopters they make sure that the Dutch airspace is and stays safe. The Air Force also supports their colleagues from the Army and Marine, for example with transporting goods and troops with transport carriers and helicopters. All this needs to run smoothly, which is why the Air Force needs to practice. But where can they do this? And how do they manage to reduce any hindrance to residents?

Searching for space

Flights are taking place all over the Netherlands. Whether it is defence or civilian air traffic. Even though the Air Force is allowed to fly and practice everywhere in the Netherlands, it is quite a challenge to find the right airspace. Due to safety and the busy air traffic of Schiphol International Airport they avoid the urban area of the Randstad, where every three minutes an aircraft takes off or lands. Moreover, there are fixed low-fly routes and areas where the Air Force practices specific manoeuvres, the eight different airports and of course rural areas and residents who live there. So, it's quite a challenge to find the right flight routes to spread out the noise as best as possible, coming from military aircraft.

That is in a nutshell what keeps Joey Ermens busy daily. Together with two colleagues and his commanding officer they form the department Sound of the Royal Dutch Airforce, where they are working on air bound sound pollution. This means the sound of all aircraft that are flying in the air. These are the kind of flights the communication department of airports receive many questions, but also complaints from civilians. "In the past many questions and complaints about air bound sound were treated by the communication department of the airports", says Ermens.

"The idea was to improve the relations between airports and the surrounding areas, but complaints and questions became too complicated and not always sufficiently answered due to a lack of technical know-how, what lead to escalations."

Ermens and his colleagues want to take these issues and questions to their office where they can use their technical knowledge to process these complaints. To maintain and improve positive relations between citizens and the defence force they require support in this process. For this they need the proper instruments.

The common goal

In this process the Air Force Information and Complaints system, short for 'LUIK', is at the heart of this, which has been used for over a decade within defence. With this system people can fill in an online form describing the complaint and the department can tie this information into their own data. This way they can see if the complaint matches the flight data. When the notifications are received, they contact the person in question and sort out the issue.

But it can quite busy in specific regions when there are exercises taking place. Ermens explains: "A training scenario is that the Air Force supports the Army to map an area. This is achieved by sending out a reconnaissance flight in that area. Next the Army sends the coordinates to the Air Force, for example to eliminate a target. To do this the Air Force needs to fly to the target again. As a civilian living in that area, you can imagine there is some hindrance from this, especially when this happens multiple times a month."

The routes towards certain practice areas and the practice areas themselves don't change often. The pilots are simply familiar with these routes, but to spread out these movements to reduce the noise pollution it is desirable to plan out different routes and practice areas. "Our need is to give our colleagues on the front insight to where the possibilities are to fly to spread out the flight movements optimally across the country and not just only over the usual routes. The target that needs to be eliminated should also be spread out more over the country. This is done by giving insight in how large the area is of where the targets are set. We notice that every time the same targets are being used in the same areas."

Our colleagues at the Army were already using a system developed by IMAGEM that determines lines of sight. Ermens and his colleagues got wind of this and came up

with the idea to develop a similar kind of system to use for noise pollution prevention.

Insight into noise

“All our flights are being registered by sensors with data transmitting, which we want to see in a tool”, Ermens explains. The Air Force does not only have insight in their own flights, but civilian flights are also being recorded. This way you know a lot of civilian flights are taking place around Schiphol Airport and when military flights are included the effects on noise load in this area increases further. Many of this data comes in from the European air traffic control Eurocontrol. With so much data about air traffic it is desirable to show all this in a clear understandable map. After reaching out with IMAGEM both Robbert van Bussel and Wim Bozelie started working on figuring out a solution to show all this data of the flight routes easily and detailed in a map.

The result is a dashboard in which the user can filter based on all sorts of criteria to see where it is possible to fly. Ermens shows this with lots of enthusiasm. “By filtering on our transport helicopters, you can clearly see that there are many exercises in the same areas. Most of time it is different units, and they are not aware of each other that a lot of flying is taking place in that region. Of course, the residents are annoyed by this.”

“This dashboard gives us the possibility to plan flights far in advance, so that we could spread out the noise equally across the Netherlands. And the more data we collect, the better we can plan out.” With the dashboard Ermens and his colleagues can notify various communication departments in advance about where is being flown. This means that there are many conscious decisions about the flight routes.

Looking at the future

Ermens and his colleagues are pleased with the solution and especially the cooperation with IMAGEM. “We got stuck with another provider, simply because they delivered a broken tooling solution. This wasn’t what we needed, so we looked for an organisation that is actively involved with us and offers new insights and we experienced that this aspect works especially well with IMAGEM. It doesn’t simply end with just a tool either, but we’re actively making progress and there is consideration of the evaluation. You can really tell there is a partnership.”

For the further development and usage this cooperation remains important. Ermens explains he has more ambitions. Over time he would like to make a direct connection with the alerts so that these can also be processed and finished in one process. The platform offers the possibilities for this. “If it were up to me, we would definitely do this together with IMAGEM and utilize the newest insights they provide.”

Patrick de Groot
Sales director
IMAGEM

Tieme de Jonge
Marketing communications specialist
IMAGEM

The technology behind the notification dashboard

The new LUIK dashboard is based on the M.App Enterprise software, Hexagon's configurable environment for dynamic data analysis. The flight data and notification records are loaded here and through configuration various interactive graphs can be added, allowing any user to easily filter and select, both in those graphs and directly on the map.

All components are dynamically connected, allowing for quick customisation to specific cases. With this, M.App Enterprise offers a powerful data analysis environment that can be deployed quickly, without programming.

FROM PHYSICAL TO DIGITAL

HOW THE TECHNICAL TEAM CONTINUES THEIR PRODUCT DEVELOPMENT

Arjen, Dennis, Marcel, Reinier, Tom, Walter, Peter, and Wim form the technical heart of IMAGEM. For months they only saw each other through a screen, but that did not stop them from developing three new products in the past eighteen months: DELTA, Schouw M.App and ONEPORT. Wim Bozelie, technology director at IMAGEM, is happy to show these developments.

Up-to-date, reliable, and complete

We know that keeping base registrations and other key registrations up to date, reliable and complete is an important task for government organisations. DELTA, a solution for automated change detection, was developed with this in mind. With satellite data, a municipality knows within a few clicks where changes have occurred in their management area, on themes such as parcels, greenery, buildings and more. The solution has been developed further in recent months. “This is made possible by the underlying product ERDAS IMAGINE, which allows us to create smart models in the Spatial Modeler,” explains Bozelie. “We can apply deep learning techniques, such as object detection or semantic segmentation, for example for the detection of solar panels. These interesting techniques can be packaged in ready-to-use models, where the user fills in a simple interface to optimise his work. And that is exactly what makes DELTA unique.”

Even smarter inspecting

Also, for the water boards, the technical team did not sit still. Schouw M.App, our solution for inspection processes, has been available for a while now. But in recent months, the team has taken a big step in the further development of this solution. In cooperation with colleague Tjip van Dale, Schouw M.App 2.0 has been released. With this new version it is possible for water boards to manage the entire inspection process in an internet browser.

Employees in the field can also perform checks using a mobile app. Bozelie goes into more detail about the technology: “For the analysis of waterways we use Machine Learning techniques from the previously mentioned Spatial Modeler. This is further fully integrated into M.App Enterprise. This allows us to offer a totally integrated service to different types of users. With M.App Enterprise, users only get the application they actually need. Another advantage is that water boards can choose to run the solution on their own infrastructure or have it hosted by us.”

Shopping for geo data

Many organisations and government institutions have to deal with large quantities of geographic data. This data must be regularly updated and distributed. In addition, the performance of all data must remain fast, reliable, and shared under all circumstances. “ERDAS APOLLO offers these possibilities, and we have been working with it for a long time,” says Bozelie.

“We have taken this a step further with ONEPORT. It is a front-end ordering system, in which on- and offline procedures can be defined for the delivery or sale of data. Simply put, it is the shopping cart on top of APOLLO. This shopping cart can settle with the end user but can also make the data available free of charge. The big advantage of ONEPORT is that the frontend can be adjusted to the wishes of the customer. Not only the colours and logos, but also the design or adjustments to the basic search criteria, so that it is exactly tailored to the end user.”

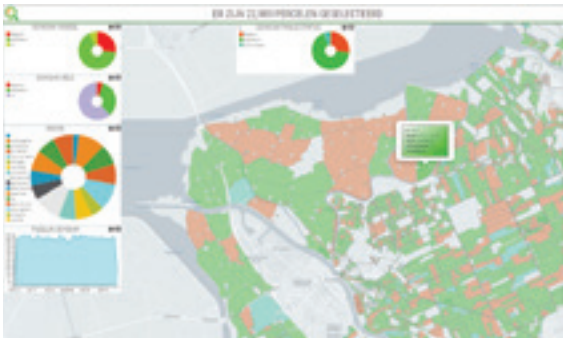
Forwards with digital twins

Besides developing new products, the technical team also spends time on various R&D projects. Bozelie: “With municipalities, we are busy researching different types of data, techniques and visualisations in the form of a digital twin. We use Luciad technology for this, with LuciadRIA forming the basis of the front-end and LuciadFusion the back end.

This allows us to visualise and interact with a lot of data. Think of meshes, point clouds, BIM, 3D building files, trees, pipes and even sound. This allows visualisations to be adjusted on-the-fly. The user can request more information and he can go underground in the digital twin. In addition, new buildings can be placed, useful for linking to the Environment Act, for example.”

Whether in the office together or digitally via webcams, IMAGEM’s technical team continues to develop new, innovative, and cool products and improve existing solutions. For more information on our products, please visit **www.imagem.nl/oplossingen**

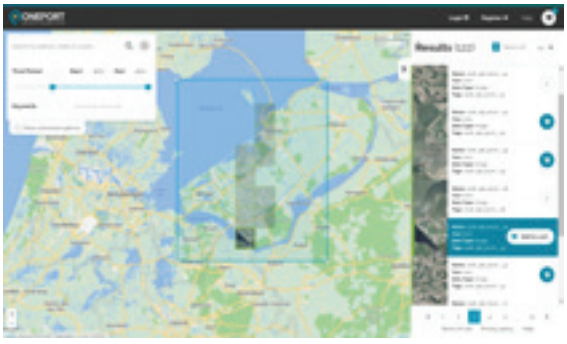
Wim Bozelie
Technology director
IMAGEM



Schouw M.App
Inspection processes from the browser and in the field.

DELTA
Automated change detection using satellite imagery.

Digital Twin
Detailed scenario planning for, among other things, the Environmental Act.



ONEPORT
Ordering system and webshop for geospatial data.


Digital twin with Luciad
See the digital reality in 5D
www.imagem.nl/digital-twin

GEO AND BIM – HAND IN HAND TOWARDS DIGITAL TWINS

Geo, BIM, and Digital Twin. Old and new concepts, sometimes just a marketing term or even a hype. What is their relationship and where do they overlap? It is time to take a closer look together with John Joosten and Freek Boersma of GeoBIMexperts. With IMAGEM, they are currently working on a project for Het Gegevenshuis, a Dutch government institution that runs various registration activities for municipalities in the province of Limburg.

All these concepts and application areas relate to location. And geo this turns more into 3D. Recently, a country-wide 3DBAG dataset became available. There is also location technology that can provide context to data collected in public spaces or in buildings, for example by displaying data from sensors on a dashboard or in a 3D city model. So, what is the next step? According to GeoBIMexperts, you can gain a lot by combining geodata with BIM and vice versa.

What is the connection between geo, BIM, and digital twin? Joosten: "In a certain way, all three deal with the same objects, but with a different approach. Geodata describes all visible objects, but in recent years, 3D technology and standardisation have reached the level of a better representation of reality. BIM deals with the construction process of usually complex projects such as buildings, tunnels, or bridges, and provides 3D data of a high level of detail of what has been built. Digital twins take what is needed to process operational data and enable decision making processes, ideally depicted with 3D representations of the important objects in the model. Thus geo, BIM and digital twins are going hand in hand towards a better governed and predictable society."

John Joosten, managing consultant and Freek Boersma, business consultant at GeoBIMexperts met each other after a meeting at Ruimteschepper, a geo-knowledge hub. Together with Douwe Blanksma, who introduced the two to each other, they saw an opportunity to start a consultancy firm using their backgrounds and knowledge of subjects such as GIS, BIM, and 3D. In addition, GeoBIMexperts has 'figureheads': experts working for other organisations who can be deployed in projects using their knowledge of a particular field. This makes GeoBIMexperts not only a consulting firm, but also a knowledge organisation.

The opportunities

Several markets benefit from the combination of geo and BIM, explains Boersma. "Typically, these are always the government and utility market. The third market is the construction industry, although geo is not yet seen as a necessity there. There are many opportunities in information management and transfer between construction and area management, says Joosten: "The construction industry is not interested in management. When construction starts a new project, it must measure again to collect data that maps the starting situation for the engineer, while ideally that data is available from the manager." If the manager is more involved in the earlier phase of a project and the construction industry better coordinates the transfer of information with the manager, they can help each other. According to GeoBIMexperts, the greatest opportunities lie in the exchange of the two processes. In the geo-world, standardisation has been going on for years, but it has not been as prevalent in the construction world. Joosten: "Now they are paying much more attention to it, because they see that there is a lot of profit to be made in exchanging standardised data. It lowers the threshold for the construction industry and increases efficiency.

Exchanging information between construction and management is at the intersection of geo and BIM. GeoBIMexperts believes that modern technology, such as digital twin, can contribute to better information transfer in the chain. It is important to know what BIM is. "It is much more than just a 3D model. It is first and foremost information management in which each party has a clear role. BIM follows the entire construction cycle and aims to safeguard the interests of all stakeholders. Gradually, we

are seeing a broader picture emerge on how to deal with BIM, both in the construction industry and as a client. Part of a good construction process is also the use of geodata. Builders are going to apply more geo in their design and the managers want to receive and process more design and revision data. Another recent development is digital twin. Boersma: “There is definitely an overlap between digital twin and geoBIM. A digital twin is particularly interesting for the owner of the data, and BIM is still part of the construction process. But the digital twin also needs explanation and context. 3D alone is not enough.”

3D is not a digital twin

Joosten believes that BIM and digital twin have become marketing terms. “Look at job openings for BIM modellers. These are often the classic CAD draftsmen/engineers. The same goes for digital twin. When they talk about a digital twin of your city, it turns out to be a 3D model. But a 3D model is not a digital twin, and vice versa.” A 3D model can help to visualize an environment, while at information level you can also solve a problem in 2D. Joosten: “A digital twin can provide insight into the quality of life in the environment. If everyone goes into the city with their smartphone, they become a sensor. There is a continuous flow of information. You can link that to a 3D model and then it becomes input for a smart city. A digital twin must have a feedback loop on which you can base decisions.” This is how you go to ‘data-driven working’. A 3D city model is a basis for a digital twin.

According to GeoBIMexperts, forerunners who use this technology and innovate are larger municipalities. “They have the size, budget and space to innovate. They primarily focus on legal tasks, but they notice the developments in 3D and test to see how they can improve the city with it.” As a second market, they point to the utility companies. “They look at the underground. It is full of pipes and cables. The third dimension becomes very important. For example, it is not practical for a heat pipe to be next to a water pipe. You need depth for that. The registration must also be correct.”

Technology as a tool

When Patrick de Groot, sales director at IMAGEM, showed the Luciad Portfolio at an information session on digital twin, Boersma was impressed. “The Luciad platform thinks in 3D right from the start. It is a fully reality-oriented 3D technology, whereas other market players add it later in the process and try to add it from a 2D platform. It is also nice

to see how easily you can visualise from different angles and with the ease you can load BIM data." Joosten endorses: "Not only BIM data, but also point clouds and meshes. We are very charmed with that." De Groot agrees with this philosophy: "Luciad was developed from the basic idea that a 3D environment is built from a wide range of data sources and live sensor information. This makes it much better suited than a traditional GIS system to provide a real-time image to many users simultaneously.

The fact that Luciad works from an API strategy also helps, because it enables developers to develop highly customised applications without the ballast of standard user environments, making them unnecessarily heavy. And it pays very close attention to factors that can help the experience and performance of the application, such as the use of GPU processing and, in the just released 2021.1 version, the use of Web Assembly, which leads to faster rendering of complex 3D worlds in standard browsers. This makes Luciad an ideal technology to bring digital twins to the public."

Het Gegevenshuis

GeoBIMexperts and IMAGEM are working together on a project for Het Gegevenshuis. Joosten: "They are now thinking about what 3D means for their internal processes. Our common goal is to research the consequences of 3D implementation. Luciad fits well with that because you don't have to tinker with other applications anymore."

Boersma is equally enthusiastic: "Het Gegevenshuis is in an area where 3D plays an essential role. One ambition they have is to be able to do everything in 3D within 3 to 4 years, what they are doing now in 2D. What I can imagine is that we will end up with a unique solution that we can implement together with IMAGEM in the future at Het Gegevenshuis and future projects."

Patrick de Groot
Sales director
IMAGEM

Tieme de Jonge
Marketing communication specialist
IMAGEM

AUTOMATICALLY DETECTING SOLAR PANELS WITH AERIAL PHOTOS

Climate change has a major impact on our environment. Rainfall is more frequent and heavier. Summers will be hotter and there will be longer periods of drought. Sustainable use of energy must ensure that the effects of climate change remain limited. Therefore, more governments want to be climate neutral. The municipality of Capelle aan den IJssel is one of those municipalities and, among other things, is looking at the number of solar panels in their municipality, an important form of sustainable energy.

More and more solar panels are connected to the Dutch electricity grid. Citizens are installing more solar panels and the number of solar parks is growing. In fact, the solar sector in the Netherlands grew by 41 per cent last year1. Over one million Dutch homes are now fitted with solar panels. To properly manage the electricity network, it is important to know where all these solar panels are located. The registration of solar panels is therefore mandatory, as this only improves the reliability of the electricity network.

However, not all solar panels are registered, despite this being a legal requirement. This can have negative consequences for climate objectives and the electricity network. For example, in places in Friesland and Drenthe, networks are automatically switched off due to an accumulation of power. That is why it is important that solar panels are registered. It is also useful to know where there is still room for more. By placing more panels, municipalities can achieve climate objectives sooner. And as part of the energy transition, as of 2022 municipalities may even require building owners to install panels. There are websites that show the potential location of solar panels, but the results differ. The question is: how do governments get an accurate overview of the solar panels installed in certain areas and how do they know where new solar panels can be installed? Remote sensing and automatic detection with aerial photos can provide a reliable answer. That is exactly what the municipality of Capelle aan den IJssel is working with.

70,000 solar panels

Arjan van Etten is a geo-information consultant at the municipality of Capelle aan den IJssel. Together with his team, he keeps track of all the geodata of the city and ensures that the city is mapped out, to create context for well-considered decision-making on various themes. One of those themes is energy transition. “That is a big challenge for us. The municipal executive promised the city that 70,000 solar panels would be installed by 2023. A few years ago, they asked us how far we had got and what more they could do to make good on that promise.” To answer that properly, they needed to find out how many solar panels were installed on the roofs of Capelle aan den IJssel and where they were located.

The team carried out analyses with several parties, but the results were not entirely satisfactory. “If you looked at the pictures, you could see that the analyses often missed a number of solar panels. So, we simply started to identify all the roofs with solar panels ourselves. We contoured the panels, counted them, and linked an id to them. Once we mapped the panels, we looked at what year the panels appeared in the photo.” Once all the data was captured, the municipality shared it with IMAGEM. Wim Bozelie, Technology Director at IMAGEM, was able to develop an object detection algorithm based on that data, train it and automate the detection model.

“After a few tries, we saw that the algorithm got smarter and produced the right detections more often. This algorithm helps us detect panels when we get new aerial photos and that saves us a lot of time.”

Deep learning

This algorithm was set up with the DELTA change detection solution. DELTA makes it possible to automatically detect changes in cities, green areas and more using various years of aerial photos. With deep learning, it is now also possible to detect ‘new’ objects, like solar panels. Wim Bozelie explains: “We use a deep learning technique called semantic segmentation. This can be found in the Spatial Modeler, the engine behind ERDAS IMAGINE. Semantic segmentation is a technique that can use context to determine whether something is a solar panel or not. The technique not only looks at the object itself, but also at its surroundings. This makes the technique very useful for detecting panels.”

After the municipality of Capelle aan den IJssel delivered the data to IMAGEM’s tech team, it could be converted

Source: [1] The National Solar Trend Report 2021: www.solarsolutions.nl/trendrapport/


DELTA
Quickly identify and review changes in large areas
Changes automatically detected
www.imagem.nl/delta

into information to train the deep learning model. Next, an application was created in DELTA to train the deep learning model to detect solar panels. After this, the application could detect solar panels based on the self-trained intellect when new imagery was available. The satellite images can be used in many ways. It is possible to make multiple selections in one aerial photo, for example, to detect solar panels in different neighbourhoods. It is also possible to make a comparison from two different years of aerial photos. This way, you can see when solar panels were installed in an area.

Helping each other

The automatic detection of the solar panels provides the municipality and Van Etten's team with a great deal of insight. "We not only know where the solar panels are now and how many there are, but also if they are on houses or on company buildings. That way we can see where there is still room for growth." And the 2023 target? "We have developed a heat map in which we can see where the panels were installed at what time. We see solar panels appearing more and more quickly, especially over the past two years. If this upward trend continues, we can achieve the target of 70,000 panels. That is a reassurance for the municipal executive." The municipality of Capelle aan den IJssel invested in the research and realisation of its own remote sensing model for the detection of solar panels.They would like to share this model with other municipalities in the Netherlands via DELTA. Van Etten: "We find it important to share such matters and insights with other municipalities, so that they do not have to take the same long road, but can join in. After all, we have put a lot of effort, time, and resources into making this happen. Other municipalities will have something that we can use, but our main concern is that we have created something that other municipalities can benefit from."

With this model, you gain insight into where solar panels are present. This supports the energy transition and the goal of becoming climate-neutral and provides information about the safety and availability of the electricity network.

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Tieme de Jonge
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IMAGEM

ARTIFICIAL INTELLIGENCE: THE COOPERATION BETWEEN MAN AND MACHINE

“In fifteen years more than half of our current employees is retired.” This is what innovation advisor Jeroen Waanders said three years ago when we asked him about the motivation behind innovation in his field of work. “If we want to continue doing the same things that we are currently doing, we cannot simply continue doing it the same way.”

With that thought in mind we explored the possibilities of new technology like machine learning in the context of geography. It soon became clear that if certain checks could be easily automated, valuable time of employees could be put into more urgent matters that required their expertise. What we also figured out was that by implementing the algorithm by itself isn’t sufficient to speed up the process. A computer model can give certain guidance to priority, but eventually it’s the human who decides which decisions are being made and how actions will follow. To speed up the whole process it is particularly important to understand the workflow of humans and to take care that the environment adapts accordingly. For this there is no better learning school than to put it into practice in a real-world scenario.

Learning from employees

That is exactly the reason why we haven’t stopped after the development of a detection algorithm for the ingrowth in waterways. We also started to support the process around it, based on what we have learned from employees who have been in the business for many years. The result of that is Schouw M.App. Through a series of sequential steps, the whole initial detection result is processed into a final decision.

User friendly app

Last fall we started with the production phase of Schouw M.App, based on the standard apps that this platform offers. It turned out that the processing within this environment allows for more control, rather than just simply dumping a bunch of dataset results into the machine. We also noticed that the standard apps not always displayed the desired information in a simple way. That’s why we remodelled ‘Schouw M.App Status and Management’ with a completely new look, which is why all desired information can be visible and edited with just two clicks of a button. With ‘Schouw M.App Assignment’ tasks can be simply distributed by multiple inspectors, through existing areas or simply by assigning a specific area.

Monitor inspection

Once we launched, we were looking for accelerating and reducing the management burden, for which we created a new aspect to our work process: the ‘Monitor Inspection’ (Beeldschermschouw). This is a newly formed part of the process which is meant to provide a first impression after the first analysis of the algorithm for the involved employees. They can then quickly review the status of the waterways and determine based on the information on screen what to do with it. This reduces the overall workload of the inspection in the field. You could compare this with an onion that you would peel layer by layer, until you reach the core. The biggest part of the area is reviewed automatically. Next, only the situations where there isn’t a conclusive judgement available through the monitor are addressed. If that doesn’t give a conclusive result, then the employees will do a site visit to confirm. We have developed this monitor inspection initially within our standard ERDAS IMAGINE desktop environment, which also does the initial machine learning analysis and what has become the platform of our DELTA solution.

Back to the drawing board

Even though the environment was developed to perform the desired checks the global corona crisis did affect our work. This meant that we all had to work from home and make sure that the platform was always available in the same way. This didn’t always work out that well, because one site did allow for accessibility while another did not. Furthermore, we noticed that for each check a couple of actions were required and it proved to be slowing the work down. And because it formed a separate tool of our work it did require some customization to get the results back in the process. With that experience in the back of our minds we went back to the drawing board and brought the Monitor Inspection into the Schouw M.App environment. Which meant a fully browser-based application without any required installation or difficult access limitations. We also decreased the amount of clicks and actions which simplified and sped up the process overall.

Now available for other processes

And that is why we do it. It is nice to have a powerful machine learning model, more so when it allows to work on all the reviews and discoveries so that it doesn't require any attention. But without the amazing support for processing of data that you need to work with, it will all be in vain. Schouw M.App 2.0 is a collection of experiences that we have learned the last couple of years. We are committed to continue with that, aiming to become more effective in processing the change detection and policy attributes. The workflow that was created through Schouw M.App allows for a large amount of processes. Like a different approach, different source data and other ways of modelling, but always with the same technological foundation. The beauty of Schouw M.App is that when delivered it is completely open to the end-user. So also, for other tasks related to inspection and enforcing we can design new solutions and put them into practice. We can only do this together with our clients. They keep us focused and tell us what could and should be improved and help us with their valuable feedback to improve both the contents of the application as the process around it. These are both the first clients we have had as the new clients we have met throughout the years.

Those collaborations are extremely valuable and show that we can achieve a lot together. We believe in an ecosystem in which we all participate, and we invite everyone to keep challenging us.

Patrick de Groot
Sales director
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PLASTIC POLLUTION, WE'RE MISSING 950 MILLION ELEPHANTS!

Plastic, from world invention to world problem in 70 years. A problem the size of 950 million elephants! How? Plastic production started in the 1950s and since then we have produced approximately 8.3 billion tons of plastic. More than 6.3 billion tons of this is waste. 5.7 billion tons of that is gone and we don't know where it went.

To the moon

That is an unbelievable amount of waste that we have lost. That's so much, we could cover the entire land area of the Earth (144.5 million km2) with a layer of waste plastic. Back to the elephants. An African elephant weighs an average of 6000 kg, so 5.7 billion tons corresponds to 950 million elephants. An African elephant is on average 3.2 meters high, so with 950 million elephants we can make almost 8 piles of elephants, from the earth to the moon. In 70 years, we have lost the equivalent of 950 million elephants to plastic waste. Where did it go?

We do know that the seas are the waste pit of the world. We regularly read about sea animals that are entangled in plastic waste or that have died with plastic in their stomachs. However, we do not know how much plastic ends up in the sea. The plastic that ends up in the sea forms the so-called plastic soup and parts of it sink to the bottom over time or wash ashore again.

Would it be possible to use remote sensing techniques to find 950 million elephants worth of plastic in the sea? That is a question that we unfortunately must answer with yes and no. It remains an unbelievable amount of waste, but it has managed to hide very well on our earth.

No observations

At the time of writing, there are more than 2,787 satellites orbiting the Earth. Some 426 satellites are used for Earth observation, of which about 27% is used for environmental observation. There, in that word, Earth observation, lies

our challenge. Simply put, we don't monitor the sea in the electromagnetic spectrum.

Figure 2, Sentinel 2's monitoring of Earth, shows it nicely. No observations are made above the oceans, which cover about 71% of the earth's surface. That saves a lot of data, data we thought we didn't need. A map of The Ocean Cleanup clearly shows the challenge, the various "plastic garbage belts" in the world arise precisely at the places where the different cold and warm gulf streams meet. So, these are exactly the places that the cameras of our environmental observation satellites do not record. Can't we find that plastic? Not yet, at least not in the middle of the oceans.

Loads of data

On the coast, for example where rivers flow into the sea, we can find plastic in the water. How this happens is explained in the article Finding Plastic Patches in Coastal Waters using Optical Satellite Data, Lauren Biermann, Daniel Clewley, Victor Martinez-Vicente & Konstantinos Topouzelis. They use Sentinel 2 data to detect plastic in spectral profile.

Like a large vacuum cleaner, the Sentinel 2 satellite takes over data distributed in 13 different bands in the electromagnetic spectrum, while flying over it at an altitude of 786 km. The image that is taken covers an area of 110 by 110 km, a big load of data. The data from the different bands, as shown in Figure 4, tells us a lot about the recorded area. Sentinel-2's range of 13 spectral bands, from the visible and near infrared to the short-wave infrared at different spatial resolutions ranging from 10 to 60m on the ground, are used to detect the plastic in the water.

When sunlight hits an object, part of the light will be reflected, which is visible to us as humans as different colours. A satellite can see a lot more, one of the topics in the article shows the spectral profile of "junk" in the sea To detect this mess, the research team developed the Floating Debris Index (FDI).

An index in remote sensing can be explained as follows: An index is a single number that quantifies, for example, the vegetation biomass and/or the vigour of the plant for each pixel in a remote sensing image. The index is calculated using different spectral bands that are sensitive to plant biomass and vigour. The calculation for the FDI was determined based on the spectral profile of "junk in the sea".

Figure 2 - Sentinel 2 recording area.

Figure 3 - Plastic garbage belts (source: Ocean Cleanup).

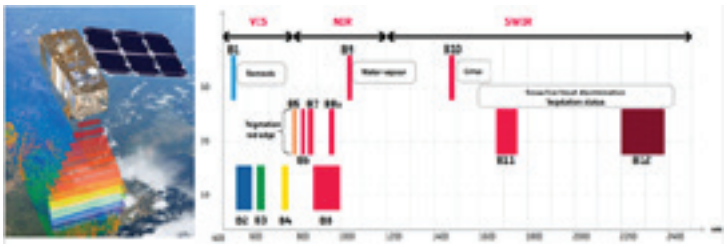

Figure 4 - Sentinel 2A data (source: ESA).

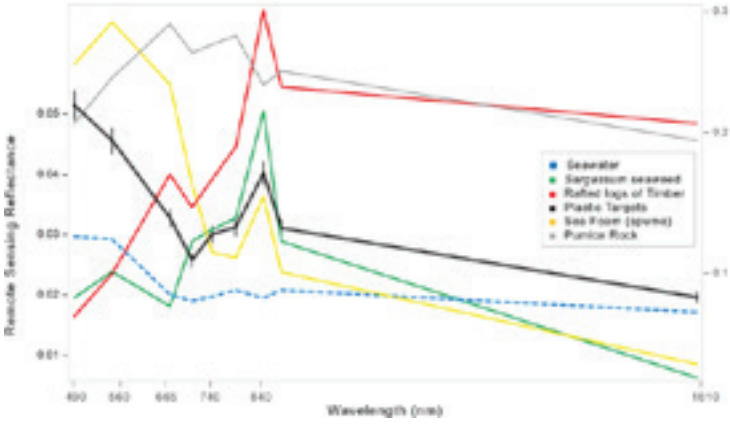

Figure 5 - Spectral 'signature' of 'junk' in this sea.

Coastal regions

By calculating the Normalized Difference Vegetation Index (NDVI) (the index for living plants) of the same area and subtracting these from each other, plastic waste in the sea can be detected. Please note that this is a rough approximation, for a more accurate determination atmospheric corrected images are used, and an analysis step based on machine learning is applied.

For now, I only use the FDI minus the NDVI. The Ocean Cleanup also has a nice map on their site showing the emissions in tons of plastic per river. For this story I took two random examples near Trinidad and Tobago and the Bosporus. Not completely random of course, the facts that there are plastic emissions and recent clear images from the Sentinel-2 program have influenced my choice.

Now Sentinel-2 images have a coarse resolution, this resolution (one pixel) is 10×10 meters. To be able to discover plastic waste in a pixel, around 60% of the surface must contain plastic. The picture below gives a representation of this, 1 pixel of a Sentinel-2 image from which the FDI can be calculated can best be compared with 8 parking spaces in which at least 5 cars are parked.

Sentinel 2 images are known within ERDAS IMAGINE, the NDVI is a standard application and the Formula of the FDI can, as shown below, be 'configured' within the Spatial Modeler in ERDAS IMAGINE.

Figure 7 - Example of locations.

Figure 8 - 10x10 meter pixel with 60% filling.

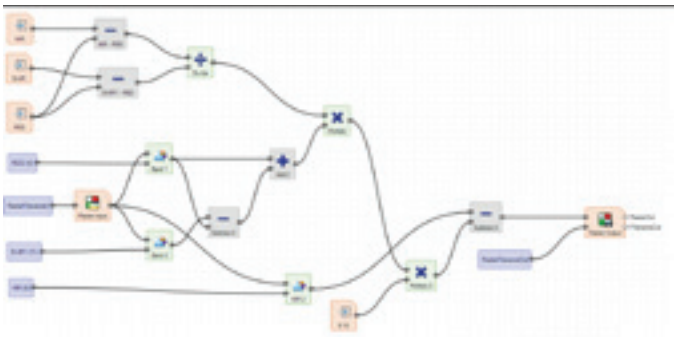

Figure 9 - Formula in ERDAS IMAGINE.

$$FDI = R_{rs,NIR} - R'_{rs,NIR}$$
$$R'_{rs,NIR} = R_{rs,RE2} + (R_{rs,SWIR1} - R_{rs,RE2}) \times \frac{(\lambda_{NIR} - \lambda_{RED})}{(\lambda_{SWIR1} - \lambda_{RED})} \times 10$$

Floating Debris Index formula (source: Nature).

Spotting Plastic

We are ready to go. The first image is a shot of the sea off San Fernando in Trinidad and Tobago. The Caribbean is negatively known for its huge emissions of waste per capita. Trinidad and Tobago have the dubious honour of taking the lead here.

On the satellite image itself we see a beautiful blue Caribbean Sea. When applying the FDI, the boats on their way to the harbour become clearly visible. Logically, they are not plant-based, and they are so large that they consist of several pixels. However, their value is too high (lights red in the image in the selected visualization). However, several light-coloured pixels are visible between the boats. Large concentrations of "junk" in the 10x10 meter sections, which in turn consist largely of plastics.

Zoomed in on the image it becomes even more visible, in that beautiful blue sea, if we look closely, there are places of plastic waste. Waste that is on its way via the ocean currents to one of the plastic garbage belts in the oceans.

We see the same effect for the Bosphorus, here too we see "yellow" spots that largely consist of plastic waste.

It's quite scary, we all know that plastic in the environment is not good. When we walk down the street, we often see enough plastic. Plastic that eventually ends up in the sea via ditches and rivers. Not only that, but it is also so much plastic that a satellite orbiting at an altitude of 786 km above Earth can detect it. How many more elephants will there be?

Harald Görtz
Business consultant
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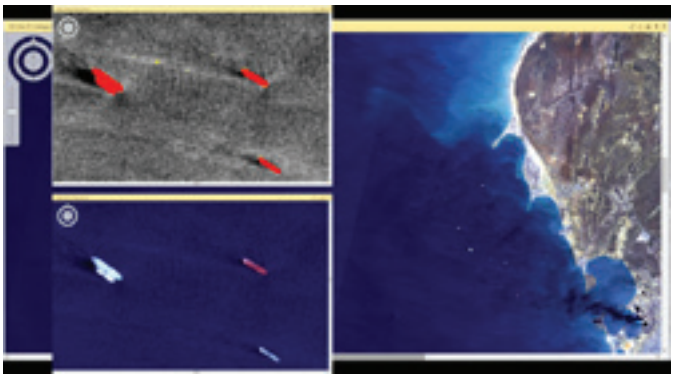

Figure 10 - FDI San Fernando on Trinidad and Tobago.

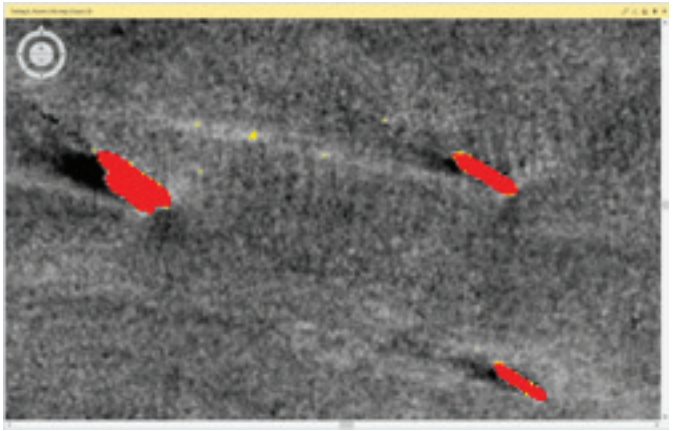

Figure 11 - Zoomed in on FDI San Fernando on Trinidad and Tobago.

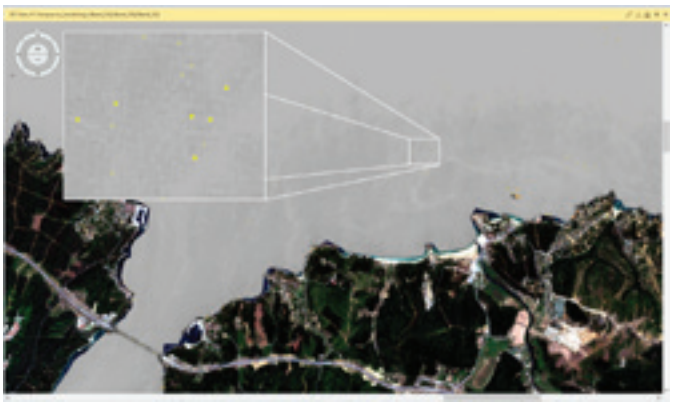

Figure 12 - FDI for Bosporus.

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