

An aerial photograph of a rural landscape. A winding river flows through the scene, surrounded by lush green fields and a small town with several buildings. The image is overlaid with a semi-transparent green and blue geometric shape that frames the text.

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IN THIS EDITION

GUEST COLUMN:

PREDICTING WITH LOCATION INTELLIGENCE AT MICROLEVEL

We want to know the future so badly. But to know the future is not possible.

Fortunately we have a plan B: predicting. **P. 4**



TOGETHER TOWARDS THE DIGITAL SHARING ECONOMY

A new approach by the government, for the government **P. 8**



MUNICIPALITY OF BERGEN OP ZOOM USES LOCATION-INTELLIGENCE TO DEAL WITH AN EVER-CHANGING CITYSCAPE

Tracking changes through advanced location intelligence technology **P. 12**



ENERGY TRANSITION DASHBOARD HELPS LOCAL GOVERNMENTS ACHIEVE THEIR ENVIRONMENTAL GOALS

From "gray" to "green" energy - a challenge, especially in financial terms and spatial area. Location intelligence technology offers the solution. **P. 16**



INNOVATE WITHOUT PROGRAMMING

Developing innovations by linking 'building blocks' to each other and visualizing data step by step. This approachable method allows you to realize new innovations within your organization quickly and easily. **P. 23**





PREDICTING WITH LOCATION INTELLIGENCE AT MICROLEVEL

WE WANT TO KNOW THE FUTURE SO BADLY. BUT TO KNOW THE FUTURE IS NOT POSSIBLE. FORTUNATELY WE HAVE A PLAN B: PREDICTING.

We use predictions to make decisions. However, municipalities encounter a few oddities. The most important one: the predictive models for the need of business parks. These show major fluctuations in the requirements. Municipalities can save up to tens of hectares in terms of a few years. Especially in smaller municipalities the fluctuations in percentages are huge.

How can those fluctuations happen? It's in the models that make the prognosis. It's in their algorithms. It's in their data. But what happens in those models exactly? And how can it improve?

Without going into detail of the technology of the current models too much: essentially, they convert the extent of the national economy into jobs, thereafter into the necessary amount of space.

The result, called the national calculated requirement, is divided over provinces, regions and municipalities. However, we're not very good at dividing it.

We are not in the possession of any good algorithms. We are, however, good at adding up. The more micro data is, the easier it becomes to build a model that is properly usable on every spatial scale level.

The micro data that is necessary for the predicting of business parks are about businesses and lots.

The idea is based on the graph in figure 1.

A lot of you will see the similarity with the product life cycle. Of course, you can state that every business has a life cycle. The same goes for every lot. Moreover, every business temporarily resides more or less on a certain lot, thus making both their cycles inseparable.

The graph shows that every business has a space requirement that is related to the extent of the business activities, let's say the revenue. When a business settles on a lot, the business often buys or rents more space than it strictly needs. The business sets up a building and ensures that it can grow in that location for many years to come.



Because a business buys space to grow, it also buys time to grow. Every time it grows, it will sooner or later be evident to the intensity with which the lot is used.

If the capacity of a lot is not in sight, there is nothing wrong. This changes if the hard, physical border approaches. The end of the growth of that place is

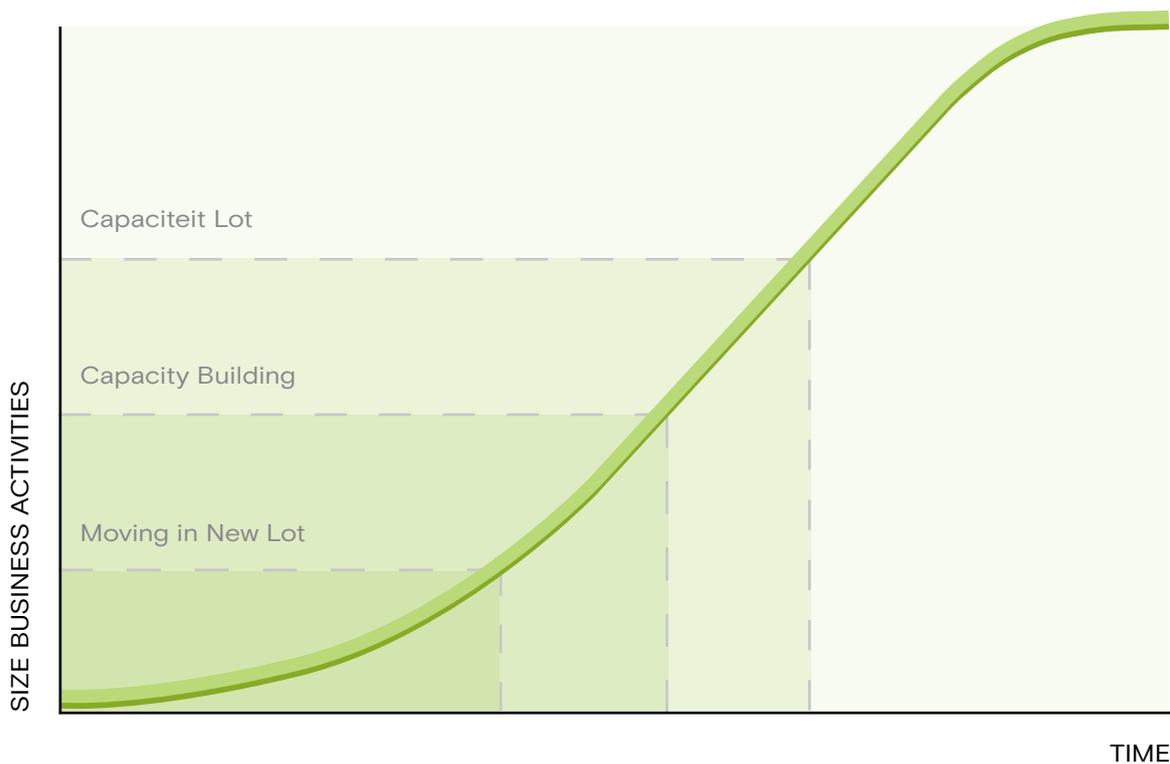


Figure 1. S-Curve Business Development

then in sight. Often, everything is done to save time, because no business likes to move. The business takes refuge in all kinds of measures; moving the canteen and office to an upper floor, the public road is used for parking, loading and unloading docks are

used, buying the neighbours lot or renting space in the immediate proximity. These measures are all observable from the outside. These indicate a shortage of space, thus a requirement for space. Adding up the space requirement from all business



The total requirement is greatly predictable per park, municipality, region, province and for the country



For businesses of certain categories that have a special space requirement or want to bring in a region it's also well to determine. Besides, those businesses can be found exactly, with name and address.



As an owner, municipality, estate agent or developer you know which lot will be vacant. Also, you can easily decide who the next residents are. Because those are also companies that have a space requirement in the future.



As a business association or municipality, you can organise a chain of business relocations, in order to minimize vacancy. Moreover, no more new terrain will be made than strictly necessary.



Financial risks of municipalities and developers are brought back to almost zero.

that are reaching into the boundaries of their lot is a great alternative to the traditional model. The advantage of this is that it can be added in any desired way. Without methodological problems, without expensive custom software. ■



Gerard Overkamp

Policy Advisor Urban and Spatial Planning

Gerard has been working for municipalities and provinces for more than 30 years, often in the combination of policy, research and data.

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TOGETHER TOWARDS THE DIGITAL SHARING ECONOMY

A NEW APPROACH BY THE GOVERNMENT, FOR THE GOVERNMENT

Climate change, flooding and hot summers. Changes that happen often very quickly, without us knowing it. People immediately feel the consequences of these changes; they suffer from dry gardens or a basement overflow. Such developments have an impact on government and citizens worldwide.

The government forms a policy to curb climate change and to deal with the consequences.

We all have to do one's bit. For example, municipalities unfold concrete plans for the energy transition. The required investments are huge and will largely have to be borne by citizens. Citizens actively contribute to the energy transition by making their energy usage more sustainable. This happens individually and on a small scale, but many hands make small work. But how do we bridge the gap between big policy and small initiatives?

DIGITAL VERSION OF REALITY

Complex problems become insightful through collecting and combining data. In the world of Internet of Things (IoT), measuring means knowing. Everywhere sensors spring up and these produce big real-time dataflows. We call it big data.

Think about smart meters or emission sensors.

We are succeeding better and better in processing data into information that is shared.

Gathering knowledge from this often takes a lot of time, and resources are constantly being sought out to simplify this. By creating a digital version of reality, modelling is made possible. We create scenarios and with artificial intelligence we try to predict

what effects the policy has on the future. A future where we safely live in freedom and where we enjoy increasing prosperity.

DIGITAL TRANSFORMATION

We are in the middle of the process of digital transformation. On a micro scale this often goes reasonably well and quite easy. However, on macro scale it's not a done deal. A government organization has many legacy systems and dated databases. This greatly limits the rapid adoption of new opportunities. The government acknowledges this and initiatives such as "Common Ground" and Samen Organisieren (Organizing Together) are additional policy models for the necessary progress in the digital transformation.

DEVELOP ONCE, USE MULTIPLE TIMES

What if we change our approach and start working from small to large? Small initiatives from teams within a municipality are often applicable for other municipalities. The big advantage is that a problem that is relevant for the entire market has already been solved, tested and implemented by one of its own participants. Relevant knowledge from the domain and the work process have been converted to an app; a smart interactive piece of software that is simple and lightweight in use. Develop once, used multiple times applies here.

If only it were that easy, because the list with demands in the business market is long. The app has to be lightweight in use, but with heavy



functionalities; easy to load with own data, safe and in accordance with the GDPR and also easy to adjust. Automatic updating is a must, because static rapports are passé. The apps have to be shared easily with colleagues and sometimes with citizens. Above all that, it needs to be user friendly.

SHARING ECONOMY

The reality is that there are often high costs associated with a system that can meet all these requirements and wishes, certainly in the business market. Consumers have access to systems, platforms and applications against payment per use and in subscription form, and increasingly in the context of the sharing economy. A sharing economy is a socio-economic system in which sharing and collective consumption is central. Think about Greenwheels or Uber. It's about a co-creation, production, distribution, trade and consumption of goods and services.

An aerial photograph of a rural landscape. In the foreground, a large, calm body of water, possibly a reservoir or a wide river, occupies the bottom right. A road or canal runs along the edge of the water. The middle ground shows a mix of green fields, some with trees, and a few buildings, including a prominent red-roofed structure. In the background, a line of wind turbines stretches across the horizon under a hazy sky. The overall scene is a typical rural or agricultural setting.

DID YOU KNOW THAT ALMOST ALL DATA HAS A LOCATION?

However, in existing systems the location component is often not used. That while coordinates are actually the universal building blocks of our living environment. Is it then not a logical step to use location and time as the basis for all issues?

VALLEY

FREE USE

Back to our solution for the government. We have now developed a one-off app for the municipality and a platform suitable for multiple use. Suppose the app is free. We are then already talking about a digital sharing economy, but with apps that are free for the government. You only pay for the use of the platform as infrastructure for sharing apps, with a cost model based on usage.

The government and businesses would work together to quickly create innovations and to deliver relevant solutions for current issues and problems. A fair model that combines the best of all participants and where participants work together for a better living environment.

INNOVATING TOGETHER

We have listened carefully to the government and have not only used our technical expertise for a modern platform, but we have also chosen a form of cooperation that fits in with this time. IMAGEM introduces the VALLEY: an environment where the government comes together to share knowledge, exchange apps and models and work together on innovative solutions that can be rolled out quickly throughout the whole government. The platform is immediately available for everyone and works with a fair cost model. Models and apps in the VALLEY are free and solve current problems for the government. This way it's possible to collaborate smart and digitally for the quality of life of its citizens.

We're not done with that, but now we can start with everything that is available: dozens of apps that cover various important themes are ready for immediate use. We now have a digital sharing economy for the government as a strong foundation and we can learn together how we can further improve the exchange of knowledge.

I'm inviting you to further shape this together. ■



Wouter Brokx
President, IMAGEM

ALSO FOR KNOWLEDGE PARTNERS

For knowledge partners of the government there is the possibility of offering value-added apps from their domain expertise to VALLEY participants.

For apps from knowledge partners or participation as a knowledge partner, go to:

www.imagemvalley.nl/kennispartners

MUNICIPALITY OF BERGEN OP ZOOM USES LOCATION-INTELLIGENCE TO DEAL WITH AN EVER-CHANGING CITYSCAPE

GROWING POPULATIONS ARE ALTERING THE CITY'S INFRASTRUCTURE AT A RAPID PACE. THE MUNICIPALITY KEEPS TRACK OF THESE CHANGES THROUGH ADVANCED LOCATION-INTELLIGENCE TECHNOLOGY.

The southern municipality of Bergen op Zoom is home to over 66.000 people. As is the case with many other urban areas, the city faces the challenges of rapid changes in infrastructure due to moving populations – both inter- and intra-city.

City planners and property appraisers at the municipality must know of all changes to the infrastructure. For example, if a citizen builds a storage unit in their backyard, it will result in a change of land value and usage. This change must be detected, validated and updated in the municipal records. Each change to land-use affects the municipality's revenue.

Now imagine the sheer volume of changes a city of this population size might generate and the impact on municipal revenue.

The team deals with a constant stream of location-data – such as aerial images and digital terrain models (DTM) – for these processes. However, monitoring change to city infrastructure can be a tedious and time-consuming process especially when comparing high-resolution images from different times, and then following up with verification and charting of these changes.

“In recent years, more data has been coming in, while existing data needs to be modified or updated. This has resulted in a higher workload, making automation inevitable.” says Arnold Kuilman, team member at Information and Processes department.



ARNOLD KUILMAN
GEO-Information Employee,
Municipality Bergen op Zoom

Previously, the change detection was done manually. The team members would have to skim through ortho-photos and DTM's visually for hours. This would unavoidably result in blind-spots reducing the accuracy and reliability of the data. The entire cycle of change-detection took much longer as well. The team quickly realised that manual change-detection for the volume of changes they were dealing with was not sustainable.

“In June 2017 we started with automated change detection using solutions from IMAGEM. Automation



Team Information and Processes (I&P) at the municipality heads the initiative of detecting changes to the landscape. The entire processes of Basic registration of large-scale topography (BGT) and Basic registration of addresses and buildings (BAG) are managed by them in-house and independently, including verification and validation.

A yellow crane is lifting a large, complex metal structure, possibly a roof component, over a house with a red tiled roof. The crane's arm extends from the right side of the frame, reaching towards the top center. The structure being lifted is made of several parallel metal beams. The house below has a prominent dormer window with white trim. The sky is a clear, bright blue with some light clouds.

DID YOU KNOW?

Municipalities, provinces and water boards create the BGT together with the Ministry of Economic Affairs (EZ), the Ministry of Defense, Rijkswaterstaat and ProRail. ¹



has drastically reduced the time taken by a single cycle of change detection as well as the scope of manual errors.” says Bas Schouteren, GIS Administrator.

Bas says, “Reliability of data, and efficiency have risen dramatically for our team. Since we are no longer pressed for time we now support the neighbouring municipalities of Woensdrecht and Steenberghe with automatic change detection.”



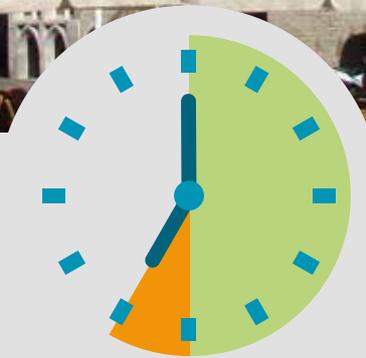
BAS SCHOUTEREN

GIS Administrator,
Municipality of Bergen op Zoom

Moreover, there have been a few surprising outcomes during the automated change detection process. Bas mentions that they sometimes discover illegal building activities, and they have identified areas where parking spaces would need to be enforced.

Boosted by these discoveries, the team is exploring how their high-end data can benefit the municipality using advanced location-intelligence solutions. Already, one of the areas that Arnold is looking into is heat-stress in the city and water permeability of garden plots. ■

Taking automation to the next level, Arnold is dabbling with Machine Learning in geospatial technology. He believes that he “can optimise change detection models with Machine Learning, reduce error levels, as only relevant changes will be identified.”



The new system at the Information and Processes department has streamlined the change-detection processes that allows the team to use their time and resources efficiently.

'BY 2030 THE ENERGY TRANSITION'

Network operators such as Enexis, Stedin and Alliant
the Netherlands Authority for Consumers a

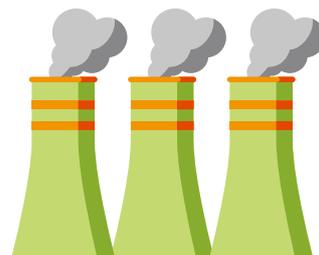
ENERGY TRANSITION DASHBOARD HELPS LOCAL GOVERNMENTS IN THE NETHERLANDS ACHIEVE THEIR ENVIRONMENTAL GOALS

GOING FROM 'GREY' TO 'GREEN' ENERGY CAN BE CHALLENGING, ESPECIALLY SO IF THERE ARE FINANCIAL HURDLES. LEARN HOW LOCATION-INTELLIGENCE TECHNOLOGY CAN BE A GAME CHANGER AND HELPS IN TRANSITIONING TO AN ECO-FRIENDLY FUTURE.

As a nation, we in the Netherlands are increasingly turning into an environment-friendly society. Being 'green' has impacted our daily lives thanks to the citizen-focused initiatives of the government. Whether it's separating waste and recycling, using reusable bags for groceries, or riding bicycles for shorter distances, we're making a difference.

The Dutch national government works closely with citizens through its local governments (municipalities, provinces and waterboards), to run multiple micro-projects to ensure a sustainable future. But what about macro-projects that will impact climate change on a national level?

These statistics are worrisome, especially since the Dutch government wants to achieve zero carbon



Traditionally, the Netherlands have depended on fossil fuels to power their industries, businesses and homes. Although known for its windmills, only 6.6%¹ of the energy used in the country nowadays comes from renewable sources.

PROJECT WILL BE TOO EXPENSIVE'
der will have insufficient funds for investment unless
and Markets (ACM) allows for higher tariffs.²



(CO₂) emissions from energy production by 2050. It entails moving away from traditional energy to clean and green energy through windmills, solar panels and so on. And with gas extractions limited after damaging earthquakes in the northern parts of the country, it is now more prudent than ever to step up renewable energy production.

This is an enormous undertaking by the government, as they are faced with rising energy demands within the country. With every household and commercial property fully-heated in the winters, the rise in energy demands is exponential. Moreover, apart from generating green energy and zero emissions, the government plans to save up to 50% of consumption

Transition from 'grey' to 'green' energy sources, the drive to save on consumption levels, and decentralising energy: the playing field is rife with challenges, ranging from both financial and spatial to technical. Despite these challenges, sustainable energy must be massively used across the country.



Location-intelligence is the catalyst in the Energy Transition initiative for both the national and local governments.

by the year 2050 by increasing efficiency in energy usage.

To make energy transition a success, the national government is implementing the project through local governments. They must meet their individual targets of lowering consumption, using more green energy and ultimately helping the nation to be CO2 neutral by 2050.

Citizens too, play a major role by generating their own energy through solar panels installed on roofs, transforming heating and cooking infrastructure from gas to electric, isolating their properties to retain heat in winters and so on.

40%

A stellar example of local governments' ambitions can be found at the Municipality of Amsterdam. The city aims to reduce emissions up to 40% by 2025, compared to 1990. They are revamping existing buildings, while equipping new buildings with energy-efficient infrastructure, and also moving to electric transportation. ³

Government agencies are grappling with implementing policies and monitoring the changes while keeping an eye on the target and budgets.

The scope and impact of this cause is large and difficult to gauge. It is hence of utmost importance to effectively monitor policy implementation and its effects on national, provincial and municipal levels.

The government needs to know: where the current renewable energy resources are located and where they potentially can place additional ones, where to replace infrastructure, where the most energy-guzzling industries and businesses are and so on. They specifically need to know 'where' because everything relies on the location, whether for planning, initiating, replacing or closing energy assets and usage.

NedGraphics, a leading geospatial service provider in the Netherlands, is collaborating with IMAGEM to help the governments and citizens alike to visualise policy implementation using an interactive dashboard – the Energy Transition Dashboard.

Hennie Genee, Manager Development at NedGraphics says, "The Energy Transition Dashboard is a dynamic dashboard that can guide the government in developing the vision required to effectively implement strategies for local energy transition across the Netherlands."

This dashboard enables real-time visualisation of the effects of deploying new forms of green energy and savings. This flexible and modular dashboard helps the federal government set up tasks and milestones required to meet these ambitions.

Jasper Arends, Account Manager Space and Environment at NedGraphics is leading this initiative. Working closely together with both IMAGEM and engineers at Antea Group, he believes that the



dashboard will enable predictive analysis by fusing location-intelligence with multi-source data. For example, one could calculate optimum location for the placement of renewable energy sources.

He says, “The Energy Transition Dashboard allows people to easily work with the tool themselves and thus become directly aware of limitations and derive possible solutions.”

The Energy Transition Monitor is based on Smart M.App® technology. Niels van de Graaf, Segment Manager Government at IMAGEM, believes that it is a unique solution as it combines multi-source datasets such as energy or public data, self-created information, and citizen feedback with location intelligence into a strong visualisation tool.

“By creating a unified ‘source of truth’, stakeholders, decision makers and local councils alike can use this user-friendly dashboard for effectively visualise policy implementation.” Using interactive maps of the local governments territories, integrated with real-time data, multiple scenarios can be drawn up to help with planning and implementation of green energy sources.

Teaming up with energy transition experts of Antea Group engineers, NedGraphics helps local governments to customise the dashboard for their specific needs. Recently, at a workshop with the municipality of Noord-Beveland, the teams jointly explored possibilities of generating green energy with a group of network managers, entrepreneurs and city council managers. And in another case, an interactive workshop was held at the municipality of Hoogeveen to analyse and discuss how the local energy ambitions could be realised. ■



Yashita Arora

Marketing Director,
IMAGEM



For more information about the Energy Transition Monitor visit the website of our partner NedGraphics: www.cadac.com/nedgraphics/themas/energie-transitie-dashboard/



At the 2015 United Nations Climate Change Conference in Paris (COP 21), the 'Mission Innovation' was announced. This mission aims to provide a clean energy future to address global climate change, while making green energy affordable across the world.

Twenty three countries and the European Union committed to invest in energy innovation and transition over the next five years. As a leading innovative country in the European Union, The Netherlands is an active participant. ⁴



If you are not familiar with Machine Learning or Deep Learning, download our whitepaper from the IMAGEM website.



WANT TO KNOW MORE?

Visit our website or scan the QR code
www.imagemnl.com/machine-learning/whitepaper/

INNOVATE WITHOUT PROGRAMMING

DEVELOP INNOVATIONS CONNECTING 'BUILDING BLOCKS' AND VISUALISE DATA STEP-BY-STEP. THIS SIMPLE METHOD ENABLES YOU TO ACHIEVE QUICK AND EASY NEW INNOVATIONS WITHIN YOUR ORGANISATION.

Since early 2018, it has been possible to integrate Machine Learning and Deep Learning to geospatial data within our technology. We knew in advance that these techniques would be available, and that gave us time to prepare. Hence in the previous issue of this magazine, you read an article from me on these innovations.

The concept of Machine Learning involves using statistics or mathematical techniques that enable computers to learn without being explicitly programmed.

Deep learning is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. Learning can be supervised, semi-supervised or unsupervised.

During our investigation of these concepts, a specific idea emerged on the areas where Machine Learning could be applied. Using open data as a base, it should be possible to apply Deep Learning to classify roof types. For example, we would identify if roofs had dormer windows on them. Stefan van den Berg, a student pursuing his masters degree from GIMA (Geographical Information Management & Applications) was entrusted with this research during his internship at IMAGEM.

The data used for this project was country-wide aerial photo datasets of 25-centimetre accuracy,

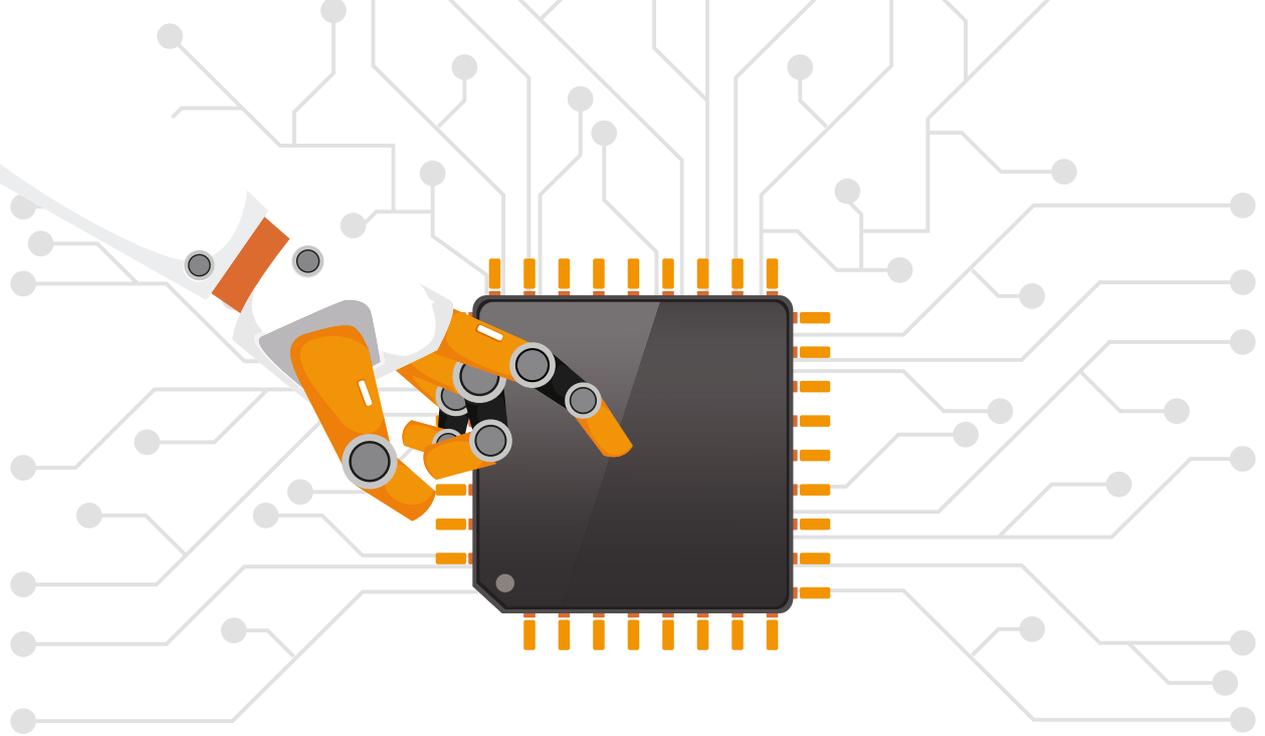
and the BAG (basic registration of addresses and buildings) data from the municipality of Bergen op Zoom in the Netherlands. The Deep Learning model looked at each building in the database on the aerial photo to identify dormer windows. The metadata was updated whether or not dormer windows were found.

The initial result was that the Deep Learning model classified the roofs with an approximate 70% accuracy. In addition, this research project helped us learn about its application and gave us insight into improving the application for more accurate results.

While we at IMAGEM can do most of the improvements ourselves, Hexagon Geospatial helps integrate further Deep Learning options into their software. The upcoming software updates and releases will therefore contain extended Machine Learning and Deep Learning functionalities.

This entire research project was created in the Spatial Modeler, thereby bypassing any need of programming. The idea of identifying dormer windows has not yet been described in any scientific research (as far as we could find). This means that we are pioneering the application of Machine and Deep Learning in location-intelligence technology. And with Spatial Modeler, it is possible to innovate without programming.

Taking the research further, the results (in form of a database) can be used to create a dashboard with M.App Enterprise® via the wizard. As an information maker, you can share the results of your investigation with other information users without having to



programme a single line of code. If you have other interesting data (in form of a database), you can also share this via a unified view on a dashboard to information users without programming. These dashboards (based on Smart M.App® technology) ensure you as an information maker have the liberty to share the insights with information makers within and outside your organisation using this cloud-based solution.

In addition to these technology advancements, Hexagon Geospatial is exploring the concept of “Smart Digital Reality”. A part of this futuristic strategy is the acquisition of Luciad in 2017. Through this acquisition, Hexagon Geospatial obtained crucial visualisation and analysis capabilities that enable dynamic sensors to be linked in a 3D environment.

To streamline this integration, Hexagon Geospatial has announced the “5D M.App Initiative”. This initiative involves development within their products to integrate all functionalities. Developing solutions in this new 5D platform will eventually realise the Smart Digital Reality. Technology forward partners such as

IMAGEM are already actively working (and gaining experience and expertise) in 5D applications. One such example is the Energy Transition Dashboard.

Due to rapid advancements in 5D location-intelligence, it is importance to recognise that technical- and domain-expertise go hand-in-hand. This creates new challenges and will see growth towards domain-specific solutions based on COTS products.

While at IMAGEM we are specialists in location-intelligence technology and understand marketing requirements, we would be happy to hear your domain-specific challenges and requirements, so that we can work together to attain a Smart Digital Reality. ■



Wim Bozelie

Technology Director,
IMAGEM



CONTACT US

Send us your challenges, wishes and ideas.

www.imagemnl.com/contact



Read how the municipality of Bergen op Zoom uses location-intelligence to deal with an ever-changing cityscape. **P. 12**

VALLEY

Smart City apps by the government for the government – now for free! Where community, platform and knowledge come together.



WE ARE IMAGEM

We are translators and location intelligence is our domain. We translate data from the changing environment around us in order to provide data-driven decision making. Our platform uses hybrid software technology to turn real-time data into useful information, through which self-learning algorithms can be used to deliver ever improving predictions.

The map of the future is a smart app, in which the complex world is translated into dynamic information and interactive infographics. The resulting insight will be used to respond adequately to changes in the world around us. This is how IMAGEM gives meaning to the things that matter and can we gain control over our future.

Read more on: www.imagemnl.com





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