EXPERTS IN CREATING IMPACT WITH AI

ML²GROW

BEYOND THE HYPE

Dear reader,

thank you for picking up (or downloading) our brochure.

Technology is moving faster than ever before. However, it's not just one technology. There are dozens of technologies and incremental innovation is struggling to keep pace. The companies that adopt new concepts and integrate disruptive technologies into their business processes are those that get ahead of the pack.

In this brochure, we would like to talk to you about **the most promising AI technologies**. These technologies have been around for a little while but are now sufficiently mature to be considered as value-enabling technologies.

ML2Grow has been devising innovative and pioneering Artificial Intelligence solutions for five years. We closely follow developments in AI and we have seen how AI can add value for businesses. We have had the pleasure of building some amazing solutions for our clients over the years and we look forward to continuing to innovate in the future.

It would be wrong to think that all AI technology is still at an experimental stage. Over the years, changes to supply chains have had an impact on production and organisation within companies. This is an area where AI offers many benefits for **demand forecasting**, compared to manual methods. It allows companies to increase the efficiency of their stock management, production planning, logistics and procurement of raw materials.

Another practical use of AI technology is **computer vision**. Powerful hardware, cameras and AI algorithms are already being deployed in industry to automate inspections and other repetitive tasks. In the past, the only products available commercially were targeted at generic problems. Now it is possible to build a flexible AI model that is tailored to your specific needs at a much lower cost.

Computers are also getting better at understanding spoken and written language thanks to innovations in **Natural Language Processing**. With the latest AI algorithms, computers can actually understand the context in which words appear. This boosts the power of search engines and makes it possible to extensively automate administrative processes.

There are many other AI applications which rightfully deserve a place in this brochure. If you would like to discuss these or anything else about using AI to solve current or future problems, please do not hesitate to get in touch.

All the best

Joeri Ruyssinck
— CEO ML2Grow

CONTENT

ABOUT ML2GROW

ML2Grow was founded in 2017 as **a spin-off** company of Ghent University and Imec (R&D hub for nano and digital technologies). Our aim is to cater to the needs and expectations of industry, which are often different from those of research and academic publications. ML2Grow pools several decades of experience at the IDLab research group in machine learning research and collaborations with leading global industrial and software development firms such as Intel, Toyota, Audi and ABB. We use our extensive knowledge to support organisations with data-driven solutions.

The founders of ML2Grow constantly accompany all the latest developments in machine learning and data analysis. They are also proud to be able to pass on the experience and knowledge they have accumulated over many years to the next generation of machine learning engineers and data scientists.

Since February 2019, ML2Grow has been **part of the Invibes Group**. Invibes is an up-and-coming player in the technology market and specialises in digital in-feed advertising. Invibes was listed on the stock exchange in 2016 (Euronext Growth Paris: ALVINV). It has around 250 employees who work in its offices across Europe.

ML2Grow has customers and partners in various vertical markets, including sport tech, biotechnology, retail and wholesale, manufacturing, media, agriculture and the maritime sector. ML2Grow differs from many other companies as it adapts its products and services to the needs of its clients, rather than specialising in one particular technology.

ML2Grow consists of **a passionate group of computer scientists and engineers**. It is also one of the few companies in Flanders to have in-house experts who hold a PhD in Machine Learning and have proven experience in successfully creating machine learning projects in industry.

1 FORE-CASTING

As a business, you know that forecasting can save you time and money. Without accurate forecasts, your sales team cannot set realistic goals or spot critical issues in advance. AI-driven forecasting lets your HR department hire new staff to anticipate demand and enables your marketing team to schedule promotions more effectively. You can deploy extra resources and scale up or down where necessary. This makes your company more efficient as you have better information and eliminate any bottlenecks in decision-making.

Traditional forecasting is typically a labour-intensive process. It often involves specialists making analyses based on limited amounts of data and their gut feelings. This ties up a company's valuable resources. It can even lead to delays in taking critical decisions, particularly when new data becomes available. Forecasting using Artificial Intelligence uncovers new insights. It works by identifying patterns in historical data and then creating statistical models that are able to predict future behaviour.

Imagine that a supermarket wants to make sure it always has sufficient stocks of chocolate bars. With AI-driven forecasting, it could predict the demand for every single item on its shelves by using historical sales data and other data related to individual items. By including external data, such as weather information, product seasonality or public holidays, AI-driven forecasting could predict higher sales of chocolate bars because cold, rainy weather is expected over the coming days. This increases your sales and avoids disappointed customers.

The more comprehensive the data that you feed into the system, the more accurate that the forecasts can become. Since it can use a wider range of data than traditional forecasting, it is possible to make more accurate predictions. With **AI-driven forecasting**, the system develops a model and allows users to gain a greater understanding of underlying factors. The next step is extrapolating this information and making predictions about what might happen in the future.

What ML-based forecasting can do for you

AI-driven forecasting also puts power into the hands of key decision-makers by unlocking intelligent planning and allowing them to gain accurate insights into future behaviour. By leveraging the power of data, intelligent planning can reveal the commercial, operational and financial implications of decisions right across a business. Studies have shown that **ML forecasts** provide the same, or even greater, accuracy of an expert in 70% of predictions.

There are two main categories of business forecasting:

- **Demand Forecasting** predicts the demand of specific products over the coming days, months or years
- **Churn forecasting** predicts customer churn, or attrition, and predicts the likelihood that a customer will leave a subscription or service

"According to McKinsey, this improved accuracy leads to a 65% reduction in lost sales due to items being out of stock and a reduction of between 10% and 40% in warehousing costs."

KEVIN D'HOOGE
INNOVATION CATALYST ML2GROW

AI, ML and Algorithms

Artificial intelligence (AI) is an umbrella term for technologies that enable a computer to mimic the learning and problem-solving of humans. A computer is programmed to simulate the reasoning used by people when they learn new information and make decisions. You probably already use artificial intelligence in your daily life, for instance in smart assistants such as Amazon Alexa, film recommendations on Netflix and internet chatbots at your bank.

Machine learning (ML) is a branch of AI and uses mathematical models to help computers learn from data. These models enable a computer to figure out patterns and make decisions without any human intervention. The computer then carries on learning on its own and improving, based on its experience.

Algorithms are sets of instructions for performing a task. For instance, the recipe we use to make a cake or the walking directions we follow to get to a hotel. Algorithms in computers are logical instructions which we program to get the computer to do something.

"Data-driven forecasting boosts efficiency and helps you get ahead of the competition. When you have the right data and draw the correct conclusions from it, you get a competitive edge."

DEMAND FORECASTING

Your historical data is quite literally a goldmine. Explore it with AI and reap the benefits!

With demand forecasting, you can discover hidden patterns and relationships between sales data (e.g. sales orders or shipping data) and internal information such as promotions, packaging sizes and new items. It lets you identify correlations between data in your ERP system and external data such as seasons of the year, public holiday and weather. Demand forecasting uses this data to **create generalised patterns** for the future.

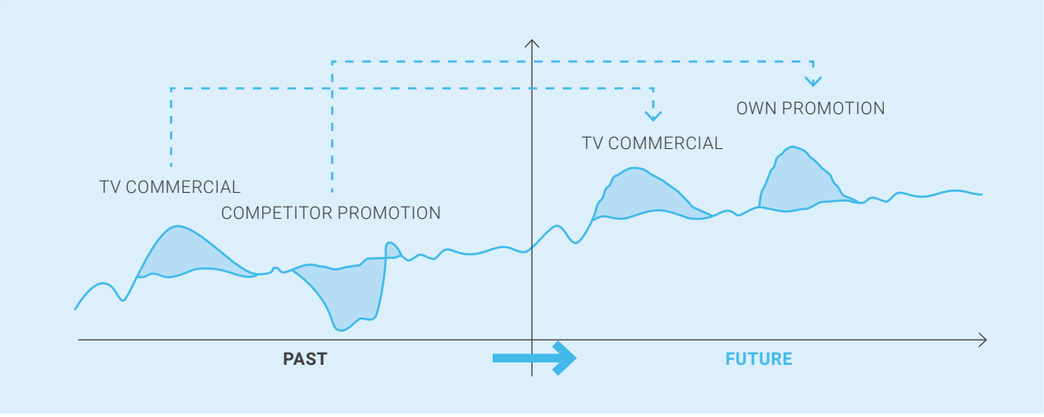
But what if there is no historical information available for your data? AI-driven demand forecasting lets you identify clusters of other products with similar characteristics and lifecycle curves. You can then use these datasets to make predictions. In this way, you can make informed decisions and estimate total sales and revenues for future periods of time. It also helps with everything from stock planning and assessing your warehousing needs to organising sales.

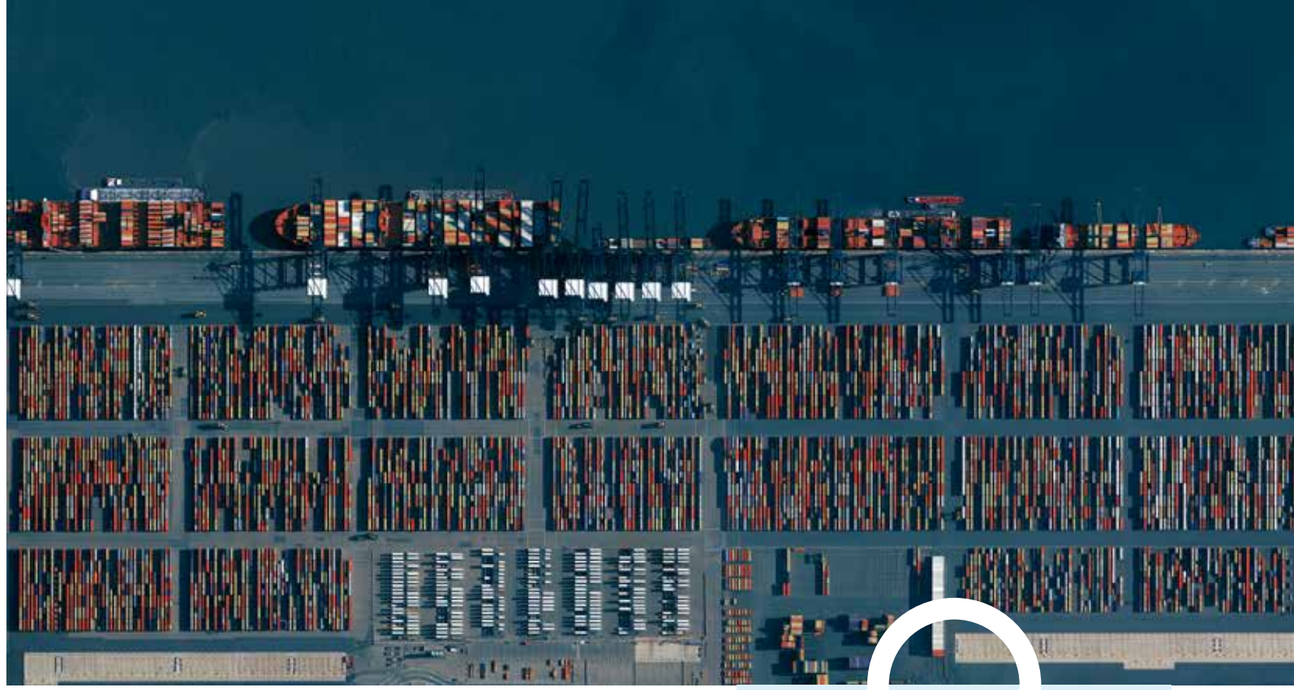
Demand forecasting can help you with:

- **Preparing budgets**
  Reduce the risk of financial decisions that can impact on profit margins and cash flow and can increase efficiency when allocating resources
- **Planning and scheduling production** Give your customers what they want, when they want and make sure that you do not overbuy or underbuy
- **Product storage**
  Feduce your spend on purchasing and warehousing by making sure you have the right amount in stock and can easily predict stock levels and restock

Our models can be used to **analyse patterns** such as:

- Demand patterns (e.g. seasonality trends)
- Business decisions (e.g. promotions and price changes, product changes)
- External factors (e.g. holidays, weather, local events)





Our models are up to 90% accurate!

Demand forecasting can be challenging in a number of ways.

To begin with, the **data needs to be converted** into a format which allows us to correlate it to other data. When doing this, we use time as a reference for uncovering the underlying patterns. Secondly, the process requires complex models, historical data needs to be extracted and then the models have to be trained using this data.

But you do not need to worry about any of this. **We tailor the system completely to your needs and no specialised knowledge is needed to implement** demand forecasting in your company.

We take care of the technical aspects and simplify the data capture process by creating 'blocks' that can **interface** to any of your applications.

Our team will explain everything to you and provide you with **all necessary assistance** along the way.

Financial forecasting

The best way to embrace uncertainty is to make plans for plausible future scenarios and recovery paths. When you do this, you can build agility and navigate today's unknowns. AI allows you to **create new scenario-based models**. These models offer deep insights, help you to deal with external forces, and support strategic decisions.

AI is able to rapidly process huge amounts of data and calibrate scenarios in near real-time. By harnessing the power of AI, you can move from simply feeding data into a system to focusing on strategic action using these continuous insights. AI adds value and is a compelling reason for looking at how to bring this power into your scenario planning process now.

CASE — **DEMAND FORECASTING**

A Belgian dairy company

A leading Belgian manufacturer and supplier of high-end dairy products contacted our team for help with its production planning.

They plan their production on a weekly basis, but this is no easy task as the company makes such a wide variety of products. There are also many uncertainties involved with supplying raw materials and purchasing end products.

Demand forecasting is a technique that attempts to estimate future orders or requests. It can then pre-empt problems by identifying potential shortages in resources or capacity.

The problem

Fluctuations in demand are a major challenge for the supply managers at this dairy company. Furthermore, as increasingly personalised products and services enter the market, interactions with customers and customers' expectations are also increasing. Raw milk is delivered and the company extracts skimmed milk and fats. They then recombine these two basic ingredients in different proportions according to the type of product they intend to produce.

Four important aspects of the planning are:

- **Freshness and storage restrictions** – The company produces natural dairy products which means it can only store these products for a certain length of time and there are also limitations on the quantities it can store while maintaining freshness.
- **Pack size and production planning** – The dairy company can produce as many small bottles per hour as it can large bottles, though it uses fewer raw ingredients for the smaller pack sizes.
- **Preventing cross-contamination** – after certain products have been produced, they need to shut down the production line and cleanse it before producing a different product. The company has to take into account the time needed to change products.
- **Risk of undocumented knowledge** – a single employee had taken care of all the forecasting work for over 15 years. None of his expertise had been written down or transferred to anyone else. This company risked losing all of this precious knowledge and expertise if he was absent for long periods of time or left the company.

"At ML2Grow, we focus on developing customised AI-driven forecasting algorithms."

Our solution

We tackled this problem in 3 stages:

1 **Analysis**
- We looked at the existing demand forecasting to see where to integrate AI.
- We identified the data sources that we could extract, including past sales orders, shipping and price lists. We then looked at how to feed this data into the model
- We pinpointed any anomalies in the data.

2 **Development**
- We developed a solution by selecting the best forecasting algorithm that could predict the required weekly volumes for each product line until we had reached the business success criteria (accuracy >90%, weekly basis, split by vendor, etc.).
- We fine-tuned the final model, debugged it, and got it ready for production.

3 **Implementation**
- We looked at where the model would be deployed, either in the cloud or on the company's existing infrastructure. We also looked at feeding back results into the existing forecasting process.
- We created pipelines for the data to flow to the model.
- We resolved the issue of 'cold starts' where a new product appears that does not have historical data. We used data from comparable products to forecast demand for these new products. We designed the AI model in such a way that it could ask questions to humans to support this process.

How we added value

- Wasted end products **reduced by 30%**
- We **optimised production schemes** so the volumes required each week could be accurately forecasted
- **Sales increased by 1%** as in-demand products remained in stock
- **The company freed up staff** (0.5 FTE per year) thanks to our automation of its manual forecasting process

"Machine learning can reduce forecasting errors by up to 50%. By using AI-driven forecasting to keep a firmer grip on stock levels, you can also reduce lost sales by up to 65%."

THIBAULT VO
CLIENT PARTNER
ML2GROW

CHURN FORECASTING

Nobody likes to lose a customer. But did you know that it costs five times as much to acquire a new customer than to keep an existing one?

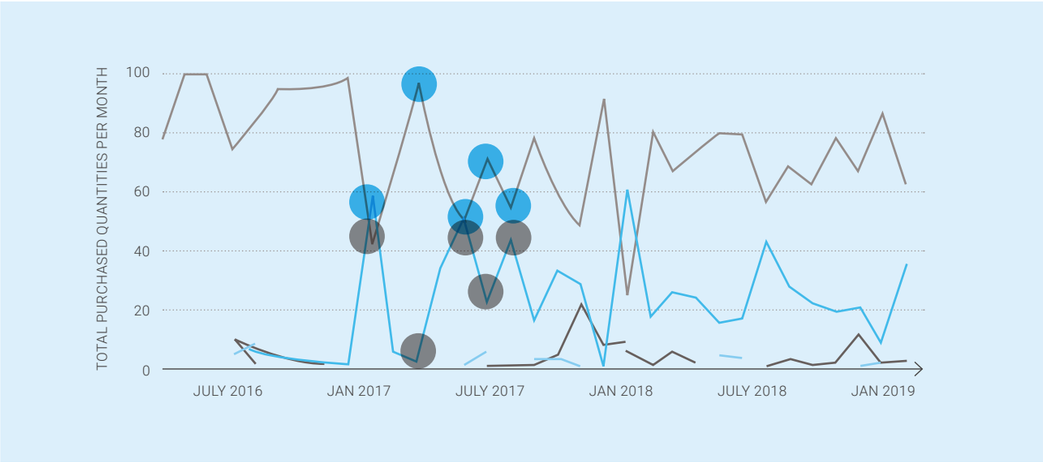
Customer churn (or customer attrition) can manifest itself in different ways, depending on the type of business. Generally, customer churn happens when a customer unsubscribes from your service or stops purchasing from you or engaging with your brand.

Customer churn can be costly for businesses as **it signifies lost revenue** and extra marketing expenses to replace those customers. Many companies do not pay sufficient attention to customer churn. While they usually spare no expense in finding and attracting new customers, the same rarely applies to identifying customers who are being swayed by your competitor's offers. However, customers interact with your company in different ways and may have different reasons for leaving. So what is the best way to deal with **customers who suddenly disappear** or stop placing orders with you?

Churn prediction involves **identifying customers who are thinking about leaving**, but have not yet made up their mind.

"ML2Grow has developed a method for accurately predicting customer churn. Our unique individual approach can make predictions at the individual customer and product level. This is a tested and validated method and it has proven to be highly accurate and effective."

JOERI RUYSSINCK
CEO ML2GROW



You should be careful about relying too much on out-of-the-box solutions in data platforms as these can do more harm than good. These solutions are designed to work in a general way and do not take into account the specific aspects of your unique relationship with your customers.

Calculating an accurate churn rate is **a complex matter**. It involves lots of different formulas, effort and interpretation. Let's be honest, it can get quite messy when you use spreadsheets or business intelligence methods. This is where machine learning really comes into its own. Machine learning excels at sifting through vast quantities of data and finding patterns. It helps you pick up patterns in purchasing behaviour and identify the tell-tale customer actions that often lead to churn, even where these actions are small or not easily measurable.

This is an impressive feat on its own, but you will see the true value of this information when you give it to your **marketeers and sales people**. It will help them to better understand your customers and reach out to them according to where they are in the customer lifecycle. For instance, it lets you easily spot customers who are at risk of churning and send them an offer to win them back.

The graph above is from an actual use case where classical and general AI models fail to be truly intelligent systems. It represents the purchasing behaviour of one customer and shows the quantities of different items bought over time.

Take a look at the grey line. Here you can see that when the customer bought the grey product, he or she ordered less of the blue product and vice-versa. It looks like customer churn. An out-of-the-box system would in fact predict a product churn on one of the two items.

However, when you take other variables into account, you get a better picture of **what is actually happening**. As it turns out, this loyal customer simply needed more of the grey product when it was warm outside, and more of the blue product when it was cold.

Machine learning allows you to **consider more information**, such as weather data, when predicting customer churn. This gives you a deeper and more accurate understanding of each customer's behaviour. When your company is equipped with this knowledge, you can create personalised campaigns at the right time and promote loyalty and customer engagement.

CASE — **CHURN FORECASTING**

HLS

HLS is a major independent distributor of beverages and catering products in Belgium. It supplies around 1,800 products (such as beer, wine, spirits, soft drinks, water, coffee and dry products) to over 3,000 customers in the catering industry all over Belgium.

The problem

The sales team could not understand why customers would stop buying white beer and churn after six months when they had purchased white beer several times per month in the past. Calculating the churn rate involves formulas and interpretation and HLS struggled to do this using traditional spreadsheets and business intelligence methods.

HLS contacted ML2Grow to create a custom analysis, development and visualisation platform for customer churn which could become an integral part of their sales team.

"With Machine Learning techniques, ML2Grow is able to find hidden relationships between customers and their behaviour and create risk profiles using limited data, such as a list of transactions."

RUBEN DELAET
DATA ENGINEER ML2GROW

Our solution

We used Machine Learning to recognise patterns in customers' purchasing behaviour. We analysed huge volumes of data and identified the characteristics shared by different types of customer behaviour. This enabled us **to identify the kinds of customer actions** that led to churn. Sometimes these actions were very subtle, or difficult to measure, such as when customers purchased smaller volumes of certain products or left longer intervals between purchases.

This approach is beneficial for companies as it enables them to take action with that information. For instance, a company could choose to actively reach out to a customer and find out why that customer is about to change his or her **purchasing behaviour** (before they actually do this).

ML2Grow solved this problem by designing **an algorithm that detects changes** in the buying behaviour of every single customer by looking at their past purchases. The system produces a brief and readable Excel report for each sales manager so that sales teams can take the initiative to contact their customers and understand what is happening.

There are advantages to being able to predict customer churn. It helps you stay focused and avoid losing customer acquisition outlays. ML2Grow has extensive **experience in the retail and wholesale sectors**. In particular, it creates recommender systems (which recommend specific products to customers or recommend customers who are open to a particular product) and churn prediction systems (which identify customers with the highest risk of churn).

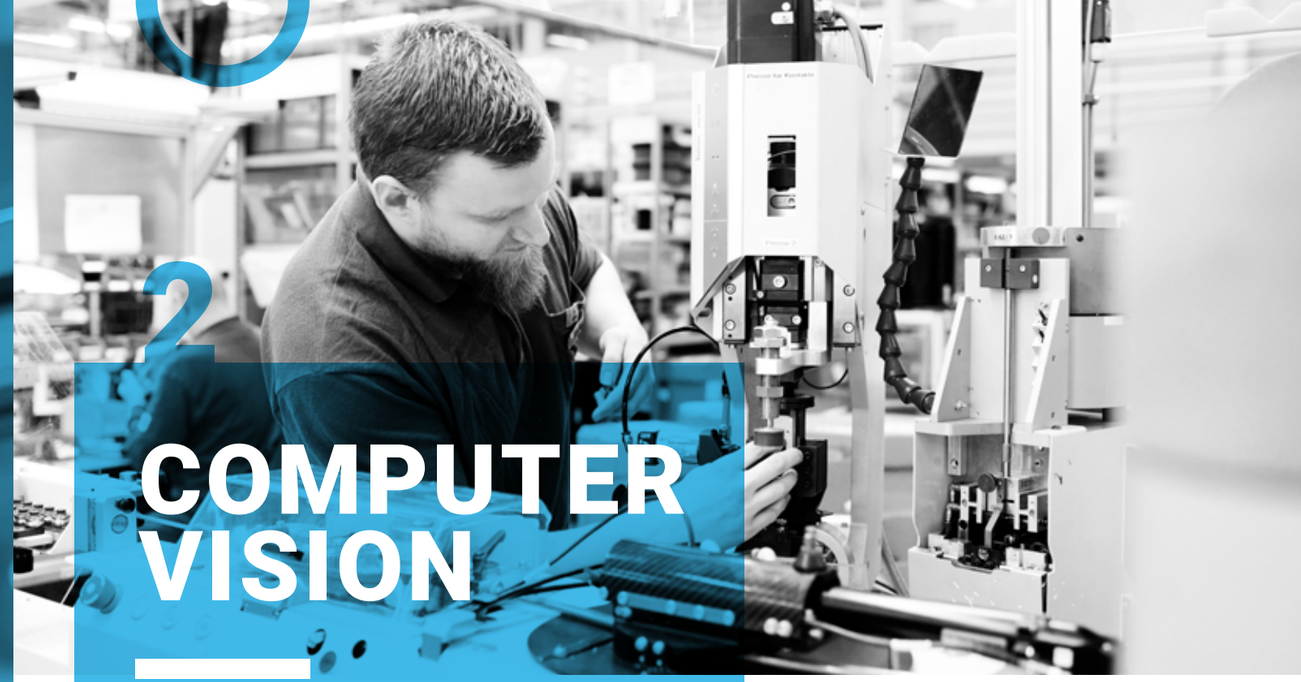
Although we cannot reveal too much about the secret sauce in our state-of-the-art solution, our approach uses churn cutoff calculations together with a classification algorithm. We combine several algorithms which create more accurate results than current models available.

How we added value

- HLS significantly **reduced its annual customer churn**
- Insights gained from customer churn were seamlessly **integrated into existing sales** follow-up workflows
- **Weekly reports** were produced showing customers with a risk of churn so that the sales team could take action

"We see how the general churn prediction algorithms used in data platforms can do more harm than good. This is because they are generic by design and do not take into account the unique relationship you have with your customers."

GREG SCHEIRLINCKX
DATA SCIENTIST
ML2GROW



2 COMPUTER VISION

Enabling a computer to see involves much more than displaying images from a webcam. To really see, the computer also has to be able to interpret the images. It may sound like science fiction to some people, but this technology has already been in use behind the scenes for some time. For instance, we have all seen social media sites that recognise photos of your friends, or mobile phones that you can unlock by looking at them.

Computer vision is about creating digital systems that can process, analyse and make sense of images or videos like humans do. We achieve this by creating algorithms that teach computers to process and understand images.

A computer vision system needs a camera to view the image and algorithms to process the image. The system can work alone, or be part of a larger machine. It can be used to spot defective products on an assembly line and prevent them from being shipped to customers, for instance. Computer vision systems are also used by medical professionals to scan X-rays, MRIs and ultrasounds in order to detect health problems. As this kind of system can analyse thousands of images per minute, it can easily surpass human capabilities.

There are different types of computer vision:

- Image segmentation
- Object detection
- Facial recognition
- Edge and pattern detection
- Image classification
- Feature matching

MULTIPLE DETECTION

LOCALISATION BY BOUNDING BOXES

SEMANTIC SEGMENTATION

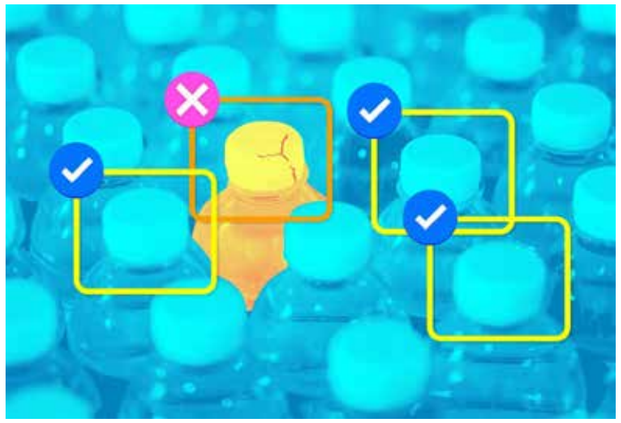
Three common applications for computer vision systems are:

- Quality inspection
- Monitoring
- Tracking and flow analysis

QUALITY INSPECTION

Many companies still rely on human operators to perform visual quality control. This involves detecting specific anomalies, such as errors or defects in manufactured goods, vehicles, windmills or pipelines. However, to remain competitive and boost efficiency and speed, manufacturers are now also turning to **automated production and quality inspection**. Computer vision systems can improve production processes by allowing fewer faults to pass, combined with zero margins of error.

Before we implement a machine vision project, we need to think about how we will retrieve the images and how we will detect any defects.



AI-BASED VISUAL INSPECTION

Image retrieval

The first step in the machine vision workflow is to retrieve the images, which usually come from a camera or sensor.

We can choose from two methods of camera inspection: **area scan** and **line scan**.

An area scan camera system inspects one area at a time in each image. It takes around 2 seconds to capture and process each image. A line scan camera system inspects moving objects by slicing the image, and can process up to 14,000 lines per second.

Defect detection

In order for the model to be able to identify different types of defects, it needs to be trained. We do this by showing the model lots of images of the desired defect (labelled images) when the system is offline. We call this a **'training set'**. We then need to check the accuracy of the model before we bring it back into production, so we need another set of images, called the **'test set'**. These images let us evaluate the performance of the model and gauge how well the model can recognise data it has not seen before. We then fine-tune the model on a third set of data called the **'validation data'**.

We have to consider two important factors when we develop **a computer vision system**:

1 **Optical illumination**
Interference from ambient lighting can cause the image to be unstable. An optical illumination platform ensures that important features of objects are clearly visible and stand out against the background. This system is tailored to the needs of the application, for instance the motion of a production line or a particular type of camera.

2 **AI model**
The AI model needs regular maintenance and tuning so that it continues to meet performance expectations (e.g. by adding new defects, using different canvases, etc.). If this step is not performed, the model may become less accurate over time.

Some of the benefits of using machine vision for quality inspection:

- Enables machines to be fully utilised and keeps production **downtime to a minimum**
- **Total quality control** which is a key buying and pricing point
- The system is **extremely fast** so your production becomes more efficient and economical
- Flexible and enables **rapid conversion** of the production
- Increases **delivery reliability** and reduces downtime for your customers
- Allows **staff to be freed up** and assigned to new roles within the company – brings benefits for everyone involved

"We implemented an automated quality control process for our customer. It helps safeguard their brand reputation by keeping faults in production lines to a minimum and enabling operators to focus on other, less repetitive tasks."

KEVIN D'HOOGE
INNOVATION CATALYST ML2GROW

CASE — **QUALITY INSPECTION**

Annabel

Annabel Textiles is a family business that was established in 1970 and has since become an international player in the high-quality fabrics market. It designs and weaves fabrics for the Belgian market and exports its products worldwide. It also imports fabrics from Asia which it distributes and finishes.

The problem

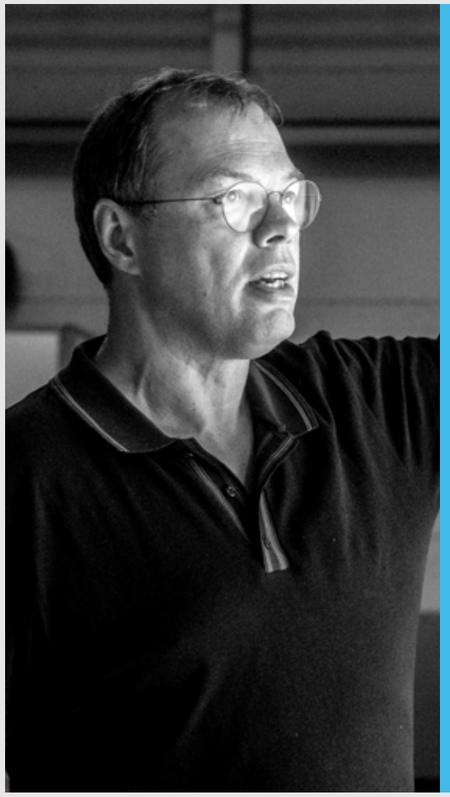
Due to the large number of designs in its collection, the company was spending excessive amounts of time on manual quality inspections to compare fabrics with standard samples. As its designs and samples were always changing, **the company had difficulty providing its sales team with the latest designs in the range**. The company also needed a simple way of presenting its fabrics to customers, instead of carrying around a heavy case with every single sample.

Our solution

We installed a camera to take high-resolution images of each sample that we used in a digital catalogue. We created an AI model to accurately label fabrics according to their properties, such as their colour and pattern. **Now the samples no longer need to be checked manually.** The company can now automatically compare fabrics against standard samples using an AI model, which increases the efficiency of operators.

How we added value

- **Greater speed and efficiency**
  Operators can work more quickly and weaving flaws are detected automatically
- **Fewer returned products**
  The fabrics are checked more thoroughly for defects
- **Improved operator job satisfaction**
  By fully or partially automating repetitive tasks



"The textiles sector is going through a difficult phase so innovation is important. This is something I believe in passionately. We chose a young company because the ML2GROW team was certain that its plans would be a success. We greatly appreciated their no-nonsense approach, expertise and agility when dealing with obstacles. ML2GROW also goes beyond a 'proof of concept' and actually puts solutions into practice. Thanks to this technology, we're confident that we can maintain a strong position in a highly disruptive market."

BRUNO DERUMEAUX
DIRECTOR OF ANNABEL TEXTILES

MONITORING

Computer vision can also be used to identify objects in video data. This type of system makes it possible to detect, recognise, count and track objects of interest. It can be used for many different applications, such as logistics in storage warehouses, counting people during public events, or monitoring areas in metro stations for instance.

The system works by **classifying and localising many objects**, instead of a single dominant object. Real-time object detection can be used to detect whether workers are wearing hard hats and other safety requirements or for accurately recognising plant diseases.

CASE — **MONITORING**

Telecoms operator and subcontractors

Over the coming years, telecoms operators want to roll out fibre networks so that everyone can enjoy faster internet without interruptions. They also want to design physical fibre-optic networks that run from the street to homes and businesses.

The problem

Telecoms operators invest a lot of money in new fibre-optic networks for high-speed internet in cities all over the world. These are also known as Fibre-to-the-home (FTTH) networks. Most of the time, the new fibre cables for these connections are underground, so roads and pavements have to be dug up when the networks are constructed. To keep costs to a minimum and avoid causing annoyance to local residents, operators **map out neighbourhoods** in advance to check the best, cheapest and fastest way to install the cables. The cost of this work depends on whether the cables are installed at street level or whether excavation is required and the type of surface.

"We were surprised by how much progress ML2Grow made in such a short time. The initial results were also remarkably accurate."

Our solution

We used drones and AI to dramatically speed up the process and reduce costs. Firstly, we flew drones over the neighbourhood that needed to be mapped out and captured all of the necessary details. We then processed the images with our AI model and traced out the path where the cables needed to be installed. We produced a list with the numbers of kilometres and the materials in each section of the path, such as grass, concrete pavers and plants. The computer system then worked out the number of man-hours and the cost of doing the job. It is much more efficient and cheaper to determine the project scope this way than with the previous method.

Work carried out

- We used a machine learning model to automatically classify and label surfaces on aerial photos.
- We built a high-performance model in a geographic information system (QGIS). This model automatically split up the path of the fibre-optic cables into segments and added surface attributes to the shape file and aerial photos.

How we added value

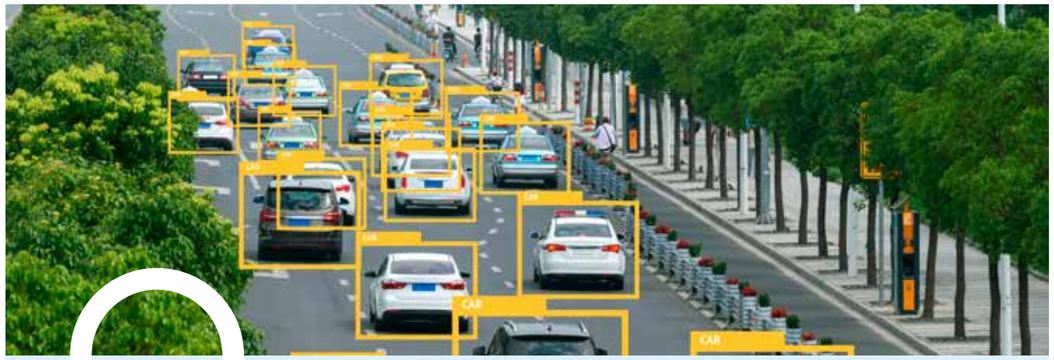
- **We saved the client a lot of time** — we eliminated the need to manually label each type of surface (grass, concrete, asphalt, etc.).
- **We delivered a model that becomes more certain over time** — the model learns from the data entered into it and gets better over time.
- **The project scope became more efficient** — we provided a clear overview of each type of surface, the lengths and the associated internal costs.

TRACKING & FLOW ANALYSIS

We can **teach systems** to process video and find objects that **match search criteria** and then **track the movement** of these objects. You may have seen this technology in self-driving vehicles such as Tesla cars. The system displays a box around the object being tracked which follows the object. The user can then see where the object is on the screen. This technology brings benefits for the retail sector. For instance, it can be used to track customers and collect data about how customers spend their time in a shop.

"The way their experts approach our challenges and the speed with which they deliver strong operational results make ML2Grow a solid partner for sustainable cooperation."

ROBIN LEBLON
CTO CITYMESH



How we implement this technology

When we undertake a project, our main aim is to remove any burden from the customer and achieve the set goals. We install the most suitable camera and set up our AI solution to process the visual data. We store data on a private storage system and in the cloud and we create a feedback system for operators. We also fully train employees to use the technology and listen to their comments so that we can fine-tune the system.

Vanheede

Vanheede Environment Group (Vanheede) employs 810 people at 14 locations in Belgium and France. It treats around 905,000 tons of waste each year, 94.6% of which is upgraded, and manages over 1,850 waste streams.

By 2023, all waste recycling firms in Belgium will be legally required to collect separated waste. It will no longer be possible to mix recyclable waste and non-recyclable waste, which is a common practice today. To combat this, Vanheede wants to visually inspect any non-recyclable waste it collects. In addition, recyclable waste such as wood and electronics have an intrinsic value if they can be collected separately.

Our solution

We created a fully automated system for visually inspecting waste that uses cameras mounted to refuse collection vehicles. When we were designing the solution, our main aim was **to check whether the waste complied with the regulations**. The system stores this information in Vanheerde's database which is linked to the company's ERP for reporting to the Public Waste Agency in Flanders, contacting customers and/or billing. The onboard computer lets Vanheerde monitor information gathered by the system and link photos to the time of collection, customer and location.

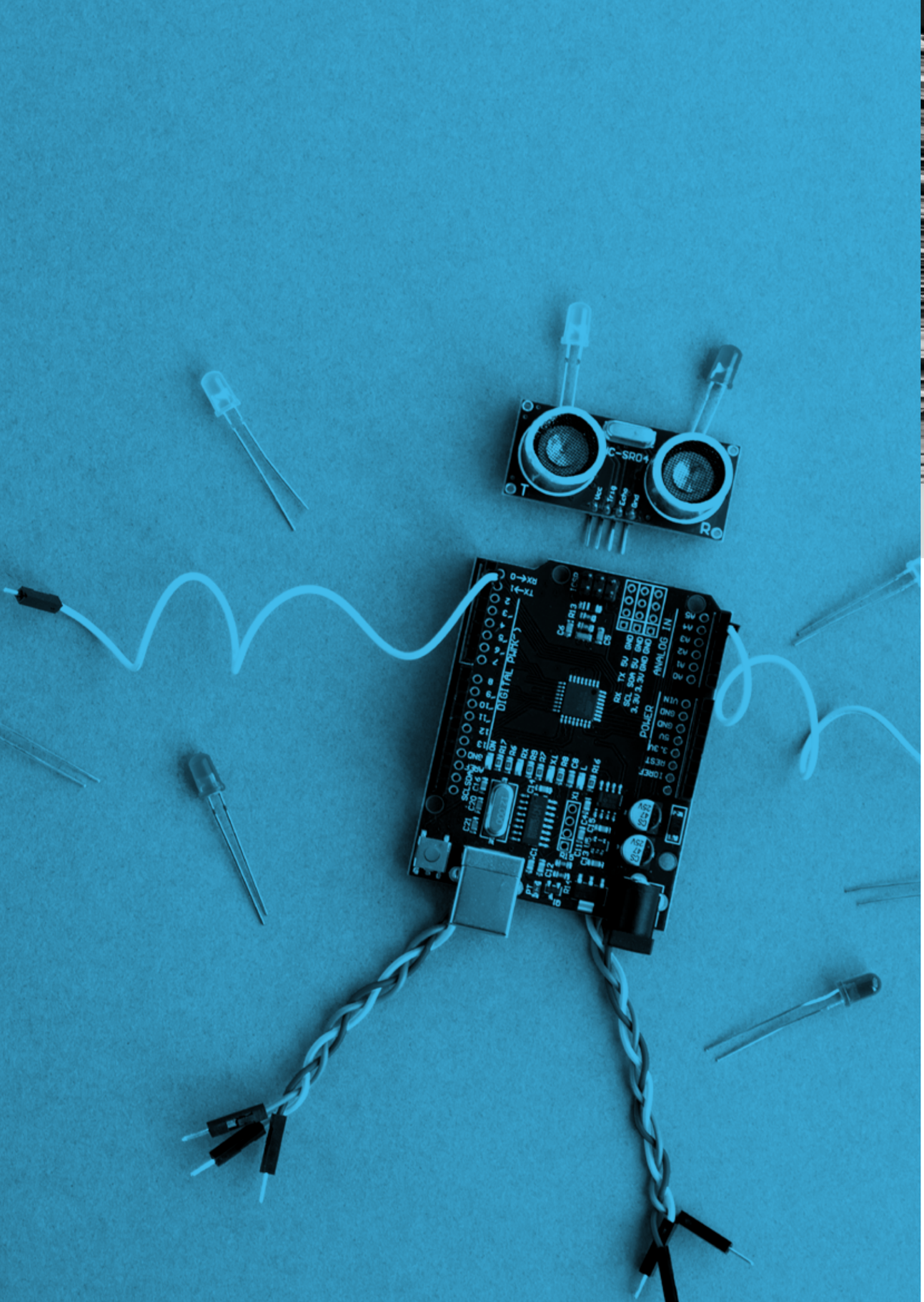
Work carried out

- Creation of the system architecture
- Construction of set-up for monitoring waste collection
- Gathered training data
- Building the AI models
- Fine-tuning the models
- Making the models operational
- Scaling up the solution

How we added value

Detail and consistency
We enabled Vanheede to publish more detailed reports for regulators (such as the Public Waste Agency)

Accuracy and improvements
We improved the accuracy of invoices sent to customers and enhanced the recycling processes further downstream



3

NATURAL LANGUAGE PROCESSING

(NLP)

Natural language processing enables computers to understand human language. Computers are naturally able to process this data much faster than humans, which means that companies are now turning previously unused data into meaningful information. For instance, information can be automatically extracted from internal reports, service logs or case files and interpreted by computers.

Recent innovations in the field of NLP have allowed AI algorithms to understand the context in which words appear. This opens the door for computers to understand spoken and written language. We can already see this when in voice-controlled smart devices such as the Amazon Alexa or Apple Siri. It is a remarkable achievement and creates the potential for more powerful search engines and information retrieval systems. It also allows you to add further automation to your administrative processes.

"Imagine what the massive amounts of unstructured text gathered in your organisation and from your stakeholders could reveal. It may hold the key to your organisation's best ever strategy."

JULIE DERUMEAUX
LEAD DATA SCIENTIST

Information extraction

Information extraction helps you **process** large amounts of text **and organise** unstructured text **into categories**. It enables you to pull out pre-defined information from text and can help you to recognise and extract relevant keywords and features (such as product codes, colours and specifications) or named entities (such as the names of people, locations, or company names).

Our text extraction tools can also enable you to automatically find key terms in legal documents, for instance, or identify the main words in customer support tickets. These tools can also be used in accounting, for classifying invoices or entering recurring invoices. Text extraction also offers **a wealth of other possibilities** such as tracking news, reports and comments and can be valuable for journalists and financial traders.

Summarisation

Machines can consistently and rapidly analyse more language-based data than humans, and do not need to stop for a break.

Summarisation allows you to:

- Identify the **most relevant** information and shorten texts
- Turn unstructured text **into useable data**
- Process **all kinds of texts**, including social media comments, online reviews and even financial, medical and legal documents

Document classification

Document classification lets you organise unstructured text into categories. It works by applying tags to documents from a predefined list and simplifies the organisation and maintenance of documents and data.

It is a good way to analyse large amounts of information. For instance, if you have open-ended feedback forms, you can find out how many responses mention your customer support and what percentage of visitors talk about pricing.

Benefits

- **Accelerated workflows and lower costs** — you can improve the customer experience and the throughput of processes that require extensive classification without increasing costs.
- **Compliance** — you can easily and comprehensively search documents for any type of sensitive information. The software can even redact the information once it has been located.
- **Discovery** — you can automatically group documents and then use this information to process an entire volume of documents to support your legal or compliance needs.
- **Migration** — you easily organise, extract, and add key metadata to document collections. This lets you simplify and organise your documents in a content management system.
- **Reduce ROT (Redundancy, Obsolete, Trivial)** — lets you identify and easily remove duplicate documents that do not need to be kept.

"As a vendor-neutral solution-builder for our customers, we believe in the power of open source as a means to kickstart projects by using building blocks that are the results of the joined efforts of thousands of developers from several small and large companies actively using this software in their environments. It enables small and midsize companies like ours to stand on the shoulders of giants and virtually extend our development team with developers from all over the world, reaping the benefits of these building blocks together. And above all, they are built on open standards, which is vital for openness and interoperability in ICT systems. 'Open source' stimulates transparency and, therefore, open competition in delivering added value to the customer's specific needs."

JOACHIM VAN DER HERTEN
CTO ML2GROW

CASE — **INFORMATION EXTRACTION**

Trendify

Trendify develops AI-powered media monitoring tools for optimising editorial workflows and is a collaborative project of Imec, Roularta and ML2Grow.
The Trendify tools enable journalists to collect information from digital data streams, such as online articles and comments, blogs and social media feeds.

The problem

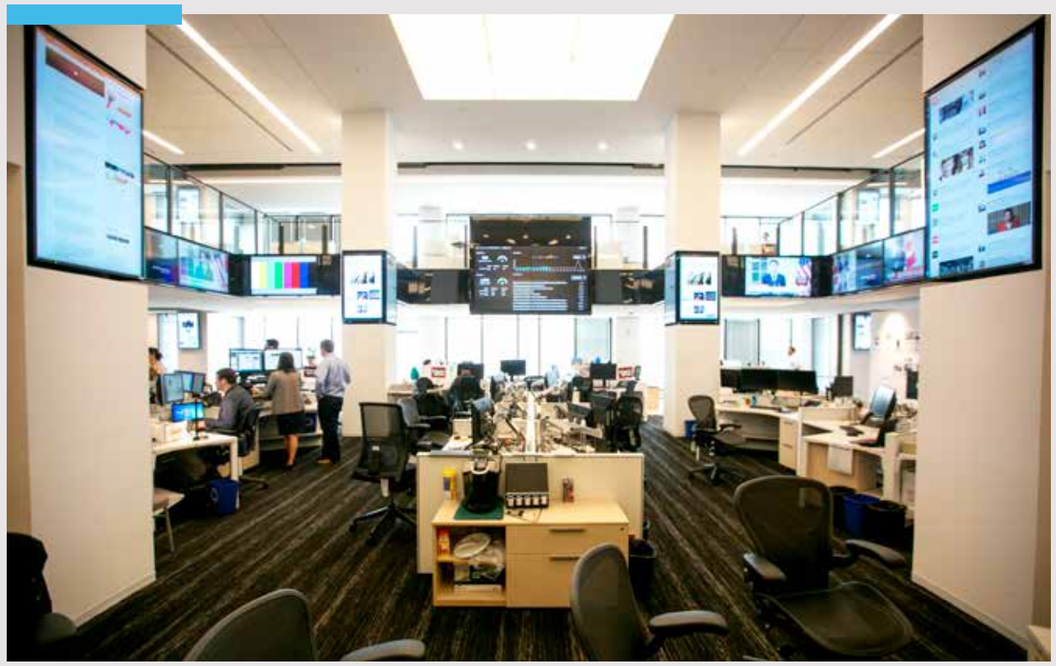
News audiences prioritise the quality of information and value trustworthy, in-depth journalism. While news brands and publishers focus on quality and consolidate their position in the market, they face the **challenge of the rapid flow of information in social and digital media**. More specifically, journalists and editors have the difficult task of deciding which trending content and opinions they want to write about. Researching this information is a time-consuming task for journalists as they often spend many hours collecting and analysing large amounts of information that is linked to underlying contexts.

Our solution

In collaboration with Imec and Roularta, we created a tool that streamlines the media monitoring process and enables journalists to **link trending content to broader trends**. This enables more nuanced, in-depth journalistic pieces that also take into account a wide range of opinions and information sources.

How we added value

- Enabled journalists to **pinpoint trending content** – such as articles, videos and tweets with high reader engagement
- Facilitated the identification of **underlying themes** – in similar time periods that connect to trending content
- Helped journalists understand the **alignment of opinions** in these content pieces



"Trendify will optimize newsroom workflows and news quality by developing a suite of AI-driven media monitoring software tools, enabling journalists to mine and synthesize highly relevant information from digital data streams."

NICK DUTRY
PROJECT LEAD TRENDIFY

CASE — **SUMMARISATION**

NewsTAPAS

NewsTAPAS is an innovative system developed by ML2Grow, in collaboration with Roularta Media Group, VRT & Imec. The NewsTAPAS project is a response to the growing demand for automation and personalisation of the way in which news items are displayed.

The problem

People feel overloaded with information and overwhelmed by digital distractions which reduces their attention span. This makes it harder to reach and retain an audience of readers. Recommendation systems currently approach this problem by selecting the news items that best match a user's profile, but this does not hold the user's attention.

Our solution

Our intention was to improve the user experience by helping **increase the user's attention span** and keeping information **overload to a minimum**.

Each publisher stores articles in a standardised way in its content repository. The different parts of each article are classified (e.g. the title, introduction, by-line, paragraphs, photo) and can be used to show the article in different ways to users. This is based on information such as the type of device used, time of day, interests and reading history of the user. We turned to machine learning to **create a profile of readers** based on their behaviour. We then determined which parts of an article best meets their needs.

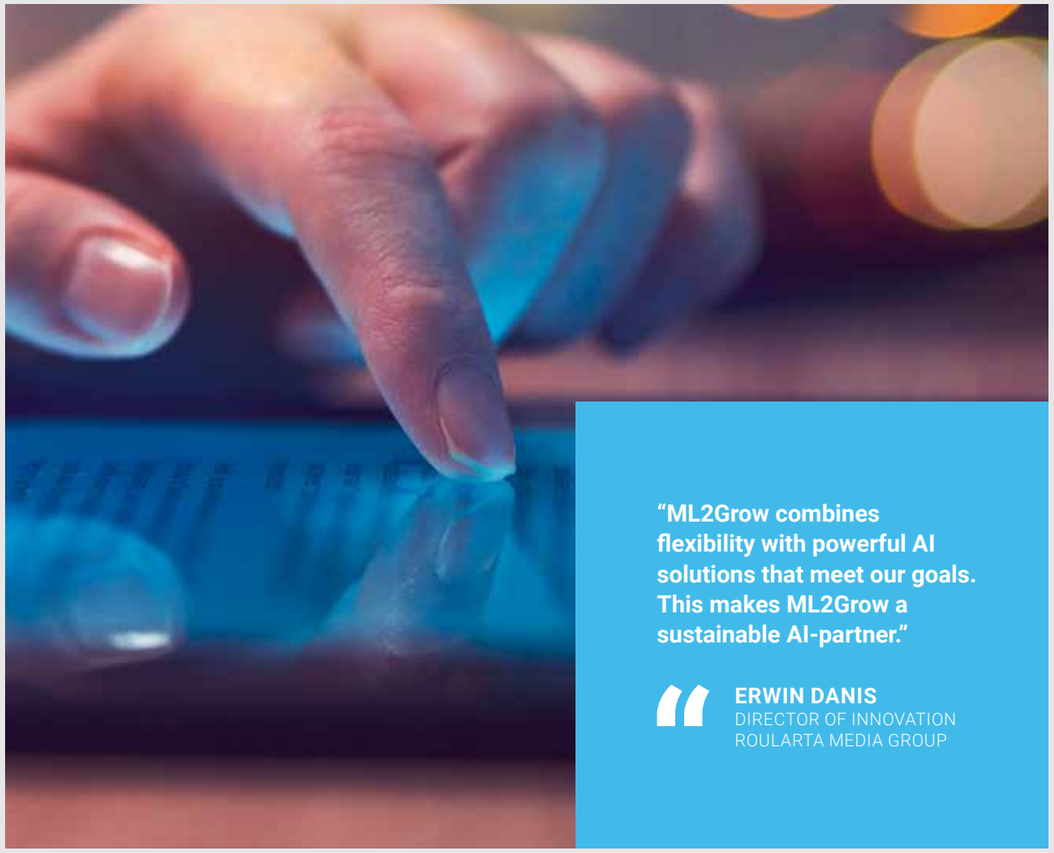
Our recommender system allows you to predict which articles will be most relevant to a reader depending on how much interest a reader shows in a particular type of new article. The system can adapt content to the needs and context of each user. While this type of system is not new, NewsTAPAS is unique because it enables news providers to not only **adapt** their news messages to reader profiles, but also to **the type of device** used and the time of day and location.

Work carried out

Recommender system
Identifies the most relevant information in a text and rewrites the content in a more concise form

How we added value

- **News content is automatically adapted**
  According to the type of device, time of day and location of the reader
- **Raised the attention span of users**
- **Enhanced the user experience**



"ML2Grow combines flexibility with powerful AI solutions that meet our goals. This makes ML2Grow a sustainable AI-partner."

ERWIN DANIS
DIRECTOR OF INNOVATION
ROULARTA MEDIA GROUP

CASE — **DOCUMENT CLASSIFICATION**

Belgian Data Protection Authority Q&A - Legislation

The Belgian Data Protection Authority (Belgian DPA) is responsible for compliance with the data protection regulations in Belgium. Every day, it deals with high volumes of questions from the public about data protection. It has prepared answers to frequently asked questions and interpretations and clarifications on the law. However, specialists at the Belgian DPA spend a lot of time answering similar questions that have already been discussed in the past.

The problem

The Belgian DPA receives questions and requests from the public by email. An expert needs to link these questions to a particular ruling and legislation, and these are then published on the website. It receives many requests that have already been published. Experts spend large amounts of time linking these requests to previous published answers. That is why the Belgian DPA wanted to explore the possibilities of automating this process, **using an intelligent agent on the website**. The agent would need to start a natural conversation with the site user and guide the conversation to the relevant publications and documents.

Our solution

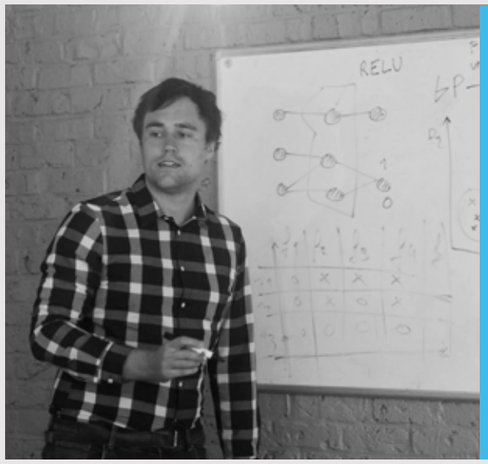
We used machine learning to solve this problem. Firstly, we modelled the topic. This meant that we could identify the relevant theme in the data protection legislation. We used this information to steer the questioning and conversation. Secondly, we created an intelligent agent. This was used to **mine information and steer the conversation**, and it functioned in several languages. If the interaction with the user did not resolve the question, the intelligent agent presented the user with a search function to retrieve relevant publications.

Work carried out

- Examining underlying structure of document collections
- Intelligent agent
- High-precision search engine

How we added value

We provided a **more efficient and natural way** to properly inform citizens and organisations.



"This project was a great demonstration of how machine learning techniques can work together to automate processes, save time and still retain a human-like interaction."

JOERI RUYSSINCK
CEO ML2GROW

MLOps

INTRODUCING A MACHINE LEARNING MODEL IN YOUR BUSINESS PROCESS

It's one thing to create an AI solution but it's another to start using it and reaping the benefits. While there are many training courses available to help you get up to speed with the former, ML2Grow is one of just a handful of companies with proven experience in helping you get the most out of an AI system.

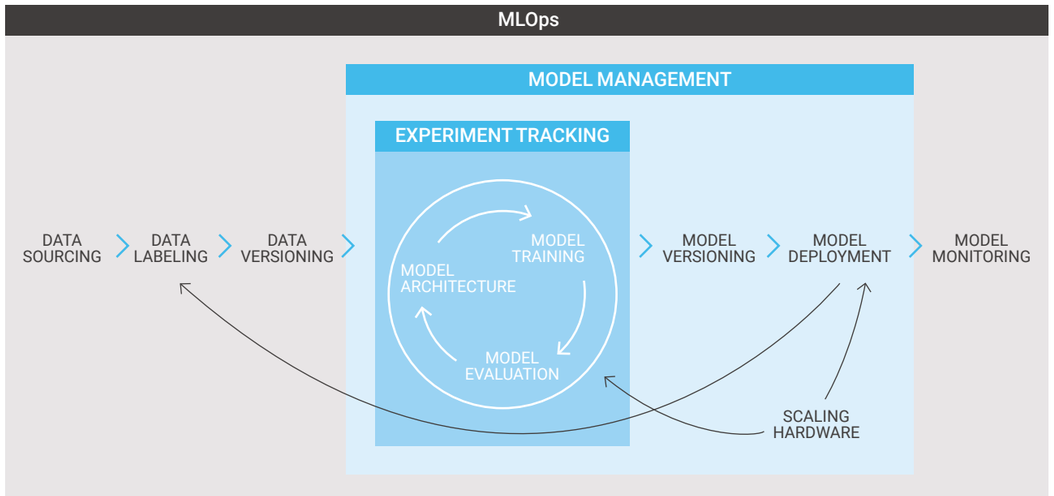
Introducing an AI solution requires a wide range of skills and services, and more than just model building and data science. The success of the solution depends on effective deployment of services, hosting of models, introduction of health monitoring, creation of efficient data pipelines and the design of accompanying software and hardware. ML2Grow has **a team of experts** who all play a role in the overall success of a solution.

Non-technical skills are equally important for the success of a project. For instance, a business problem needs to be correctly translated into an appropriate technical solution. This makes it easier to adopt AI in the workplace and transfer knowledge. We have put methods and processes in place to guide this process.

When a model has been successfully deployed into production, it still needs monitoring. This is because unexpected changes, such as a new geopolitical conflict or unidentified objects on images, can suddenly stop it from working properly or cause it to become less accurate over time. When this happens, your team is faced with starting again by preparing production ready data, retraining the model and then cobbling together a script that may or may not help to get it up and running again.

However, there is another way. Machine Learning Operations (MLOps) solves these problems by putting into place tried and tested approaches to data management in a repeatable framework for developing, testing and deploying AI models. **MLOps makes it possible to deliver new models like any other type of application.**

MLOps is a fairly recent term and encompasses a set of best practices. These allow AI algorithms to be efficiently and robustly introduced into operational systems. These best practices can be divided into design, model development and operations stages.



Design

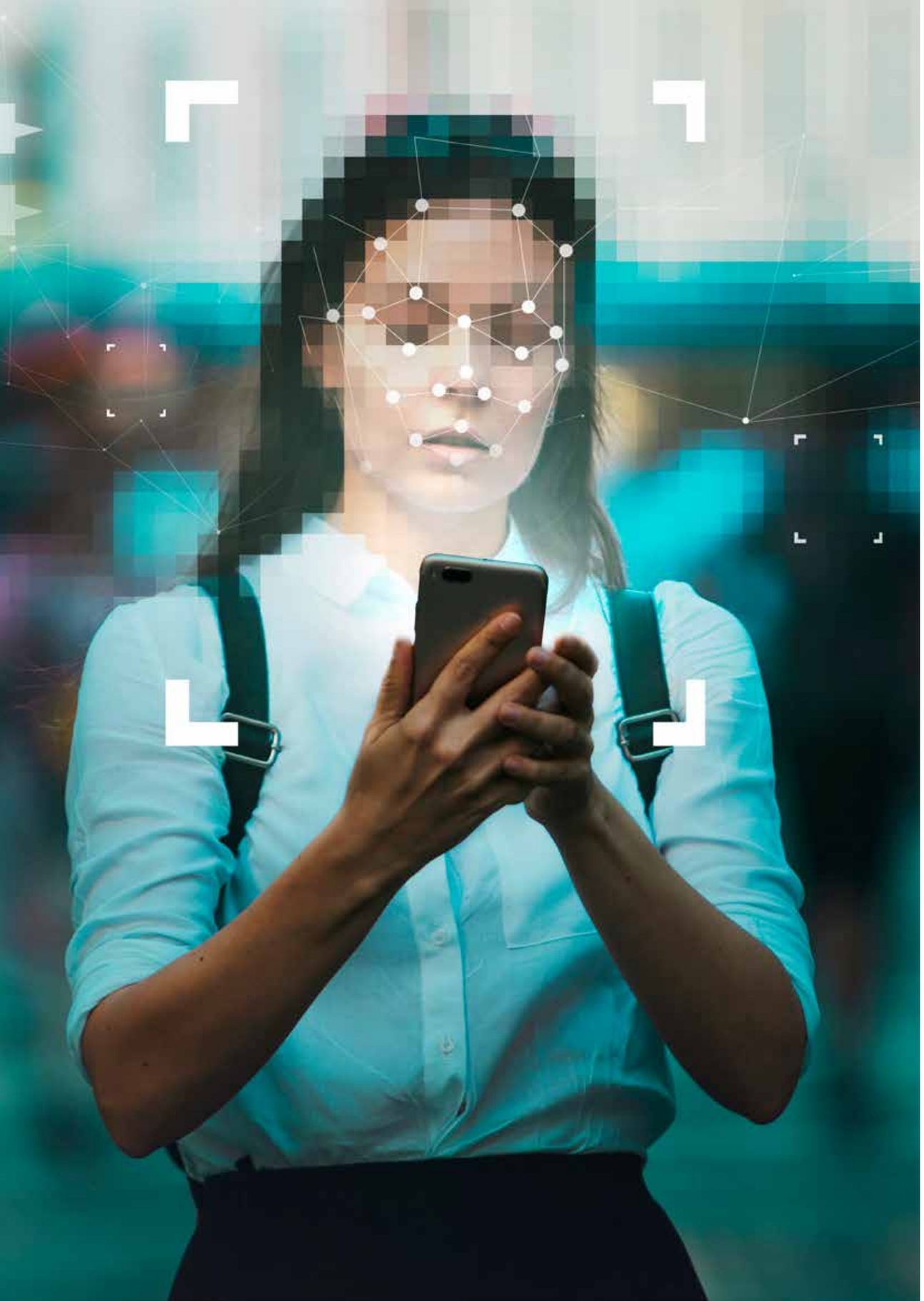
In this stage, we focus on **understanding the business** and how the technical solution we introduce will **impact the workflow**. ML2Grow's AI roadmap is a good example of how we structure solutions. It is important not to lose focus about how the end solution will impact on the business process. That is why we need to constantly ask ourselves the following at each stage: "how will things be done differently when the AI solution is in place?" We also calculate the return on interest, determine the involvement of stakeholders, consider the scope and design, and start the development plan.

Model development

In this stage, **we create the AI component**. This involves identifying and transforming data, creating features, selecting a model and training and evaluating it. We carry out these processes iteratively until we have achieved the business goals. We use rapid application development tools to speed up this manual process. We also use MLOps tools to keep track of the models, experimental results, parameter settings and datasets used.

Operations

In this stage, we devote all our attention to **bringing the model into production**. We monitor the model and detect significant risks, such as model drift. We also implement strategies and tools to automatically retrain and deploy new models. This involves data engineering expertise, but also interaction with the environment and sensors.
We always stress the importance of creating a production-ready repository where the models can be stored and setting up a model registry to keep all of the metadata for the model. Bringing machine learning into production is extremely challenging. We know this from experience, as we are constantly launching ground-breaking AI products for our clients. After delivery, we take care of the hosting, maintenance and support of the system. However, before a model is deployed to production, the client has 3 important decisions to make.



1 Hosting

Most machine learning models are used in 'batch mode'. This minimises computational time and reduces data source dependencies. The models can also be used in real-time, but this requires dedicated computing and data services and significantly adds to the cost.

For certain use cases, such as computer vision, we embed the machine learning models in devices. In other use cases, cloud computing may be the most cost-effective solution. **We offer a full service package for our AI models.** This means that we take care of deploying and scaling the model, and we make the entire experience worry-free for our clients.

2 Maintenance / support

As computer users, we are all familiar with security updates and other updates for efficiency or new functionality in our operating systems and software. **Like any software, AI also needs maintenance and support.** Our full-service package includes these types of services to give our clients full peace of mind. We will ensure that the AI system is automatically updated and secure. If you would like to extend the functionality of your AI solution, or if a problem occurs, we offer various forms of support through our SLAs.

3 Retraining or re-calibration of the model

AI systems need to be frequently updated with the latest information. The system can then be designed to retrain the AI model using this new data without the need for human intervention. We configure the system and carry out quality checks on the new model before bringing it into production.

Some models need to be recalibrated less frequently. We offer services for this using our in-house infrastructure. If your model just needs to be retrained, little human intervention will be required. However, if you want to add new features to the model, then this will require more in-depth training.

MLOps as a Service

Artificial intelligence (AI) is a powerful technology that can be used in a variety of use cases. However, each AI model is only able to solve specific, narrowly defined tasks (e.g. detecting known defects, sales forecasting). The model also needs to be retrained over time so that it remains relevant, just as we need to recalibrate any digital tool to keep it accurate.

The sheer power of AI systems to discover tiny, hidden details in vast datasets means that they need dedicated computing and storage infrastructure to run smoothly.

The algorithms in the systems also need to be constantly monitored by humans, as they can only 'think' within certain, narrow limits. Let us explain that a little. Our physical world is changing at a rapid pace and becoming increasingly interconnected. As a result, AI needs to quickly detect patterns. However, this interconnectivity also paradoxically poses a risk for existing AI models when events are not accounted for in the data (i.e. only the symptoms are reflected in the data). That could be because the events have occurred in a wider context, such as a global pandemic (e.g. COVID-19 crisis) or a geopolitical crisis (e.g. the war between Ukraine and Russia).

At ML2GROW, we fully understand that not every company has the resources to invest in specialised infrastructure and AI experts (unless they are a multinational such as Google or Facebook). However, we firmly believe in the power that AI puts at the fingertips of companies to enable them to identify new insights. That is why **we offer 'MLOps as a Service' for companies that want all the power of AI, but without the burden of operating and maintaining it themselves**.

Deploying a machine learning model can sometimes be a headache. Your IT or data scientist team will get stressed from time to time because your model crashes. It seems to take aeons to set up the system, you do not have version control, and you cannot scale the capabilities of your AI system. You may feel like you are lost in a dark tunnel, but fear not. **Our MLOps as a Service means you will be up and running in no time at all.** We will fully set up your infrastructure (at ML2GROW or via Google Cloud) and get it ready for you to use. We will semi-automate your deployment pipelines and neatly integrate your development. We will then make sure that your data is cleansed, validated and prepared for the next round of training. All that remains for you to do is to get started with exploring your AI.

Our package offers you **full peace of mind** and includes the setup, management and maintenance of your infrastructure. This leaves you free to focus on your daily operations, boosted by the power of AI.

Our MLOps as a Service comes with two services, but without twice the cost.

- MLOps platform
- In-house MLOps team

Our packaged services have a unique range of benefits

- **Keep costs under control** – resources are allocated according to the volume of data we capture. We apply our best practices to the hosting. You will start to save money from day 1 after migration by paying a single monthly fee.
- **We become part of your team** – we will be able to keep an overview of your roadmap through our account management meetings and we will become your trusted advisor.
- **Flexible, adapts to your needs** – your hosting, monitoring and training requirements will all be outsourced to our team of data, cloud and AI engineers. When you need additional support, simply call or email us and we can scale your business up or down.
- **A great selection of tools and frameworks** – we love open source tools and frameworks and we are experts in leveraging these for the benefit of our clients.

Are you interested in an alternative solution? Do you need temporary infrastructure to retrain your model? Get in touch and we will be pleased to discuss this further.

GET IN TOUCH

If you would like to see how AI can solve your current or future challenges, please get in touch.

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KMO-PORTEFEUILLE
GEREGISTREERD DIENSTVERLENER

Over the past few years, we have been fortunate to collaborate with the following companies

2GROW, acc, alterodu, AMARON, ANNABEL, AUTOMATION, BRABO GROUP, Bright., CHRISTEYNS, CIBORIS, CITYMESH, CMB, DATA SCOUTS, DOBCO, Dossche Mills, EQUALIS, ESKO, EURONAV, Fiberklaar, FMT office, GBA, Google, HLS, HOORCENTRUM AERTS, ibz, inbiose, INDROS, inex, invibee, LAUWERS & SEUTIN, MAGICS, MEDIAHUIS, MedTech Europe, mypitch, NOORDZEE DRONES, OQTON, OVIZIO, Port of Antwerp, port, RENSON, Roularta Media Group, SMULDERS, televic healthcare, Trendolizer, URBAN CROP SOLUTIONS, VANHEEDE, Vlaanderen is maritiem, Vlaanderen is zorg, vrt Innovatie, Z PLUS

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