ARTIFICIAL INTELLIGENCE FOR BUSINESSES

IMEC SPECIAL ON THE OPPORTUNITIES AND CHALLENGES FOR THE INTEGRATION OF AI IN BUSINESS PROCESSES

imec

Flanders invests €30 million in artificial intelligence

The Flemish Ministry of Economy, Science and Innovation has made 30 million euros available to get Flanders to the head of the pack on AI. In the coming years, this AI-impulse program will be centered around three main pillars:

STRATEGIC BASIC RESEARCH

TECHNOLOGY TRANSFER & **INDUSTRIAL** APPLICATIONS

SUPPORTING ACTIVITIES awareness, training, ethics...

This publication, as well as the online AI special from imec magazine, explains you more about imec's role in this impulse program and how, as a company, you can benefit from it or contribute to it.

Read the complete online version here:

WWW.IMEC-INT.COM/EN/AI

Reducing the risks of premature births

Complications caused by premature birth are the global leading cause of death in children under five. Yet, according to the World Health Organization, three quarters of these deaths could be avoided by known and relatively inexpensive measures. One of these measures is the administration of corticosteroids to promote fetal lung maturation in case of an expected premature birth. However, since this treatment seems to be most effective between two and seven days before delivery, good timing and a correct assessment are important. Aspects for which even specialized doctors give themselves a lot of room for improvement. That is why an AI algorithm was developed at IDLab, an imec research group at the University of Ghent, which aims to support the medical staff in estimating the risk of premature birth. **Continue reading on p.4**

AI in industry 4.0: two angles to value creation

It seems obvious that AI can add value to your business processes. In practice, however, it is not always easy to discover the real opportunities and to avoid the obvious pitfalls. Joris Vanderschrick, business development manager digital innovation services at imec, sheds light on the matter from two angles: AI to optimize internal business processes and to enable new business models. **Continue reading on p.3**

Radar and video: a cooperative method for sensor fusion

Accurate detection and tracking of road users is essential for driverless cars and many other smart mobility applications. As no single sensor can provide the required accuracy and robustness, the output from several sensors needs to be combined. Radar and video are an especially good match, because their weaknesses and strengths complement each other. Researchers from IPI – an imec research group at Ghent University – developed a new technique to optimize radar-video fusion by exchanging information at an earlier stage. **Continue reading on p.5**

"Imec focuses on artificial intelligence for smaller, complex datasets. This distinguishes us from the global players who are already catering to the market of big data."

Jo De Boeck, Chief Strategy Officer imec

And more...

The AI impulse program is a collaboration between the following partners, initiated by the Flemish Ministry of Economy, Science and Innovation (EWI).

FLANDERS MAKE · imec · KU LEUVEN · sirris · VIL EMPOWERING LOGISTICS · AGORIA · VIB · VUB · vito vision on technology · voka Kamer van Koophandel Limburg · Universiteit Antwerpen · UHASSELT KNOWLEDGE IN ACTION · UNIVERSITEIT GENT

Flanders amongst the global leaders in AI research and transfer to industry

Jo De Boeck, Chief Strategy Officer imec.

Artificial intelligence often evokes images, dystopian or not, of a future where robots and machines are smarter than humans and may have taken away our freedom as well as our jobs. AI is a catch-all phrase that has now also reached the people in the street and is subject to many misunderstandings and prejudices.

In industry, however, there is a better understanding of AI than one might suspect. In April 2019, VLAIO and imec organised a workshop at Agoria in Brussels during which we collected the first feedback from companies on our plans in the AI impulse programme. I was pleasantly surprised by the level of knowledge about AI, the sense of reality and the extent to which Flemish companies are already working with it.

In my opinion, artificial intelligence in the the business world should only be about one thing and that is value creation. In which scenarios can AI, just like any other technology, offer added value over an existing situation? With data often being an important factor: how can one extract relevant knowledge from a dataset that is impossible for people to thoroughly understand?

A well-known concept in big data and cloud computing, where Asian and American players have been in the driving seat for some time now. For Europe and Flanders, there are still plenty of opportunities to develop AI-based applications using smaller, but extra complex datasets. How, for example, can you build machine-learning algorithms on data that is unclear or strongly contaminated? And how can you analyse this locally without having to address large cloud-based servers? In many cases, small data is just as important as big data.

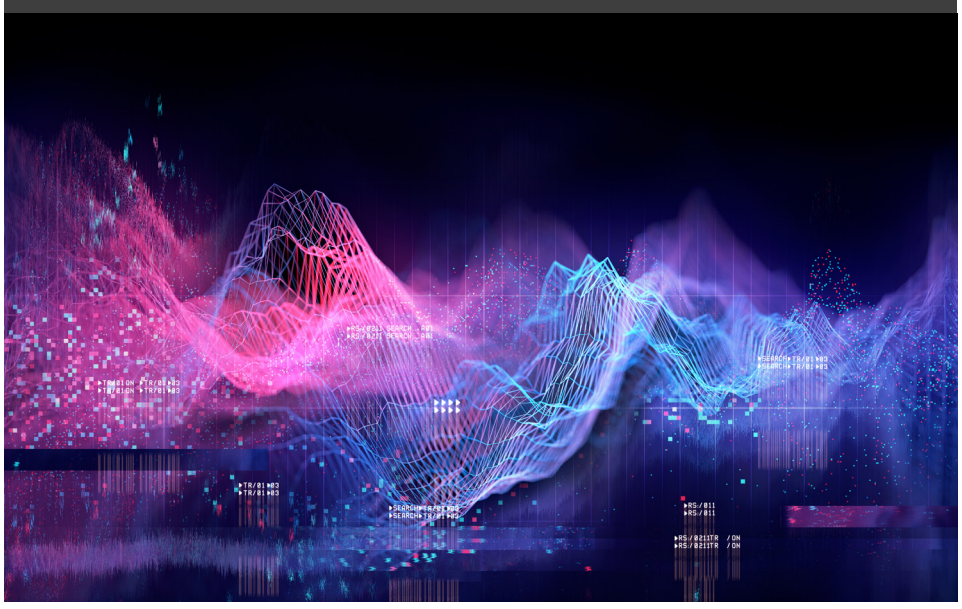
Also, Flanders and Europe have a potential pioneering role to play in the non-technological aspects. How do you deal with data in an ethical and democratic way? How do you make artificial intelligence transparent, reliable and accountable? All these aspects - and much more - are addressed in the AI impulse programme that will run in the coming years. In this AI-special, we provide a glimpse into the role that imec intends to play in this and how we work together with our partners. I am already looking forward to the exciting time that we, together with our research partners and the business community, are going to have to bring Flanders to the top in AI research and its applications in industry.

IMEC RESEARCH FOCUS

Three proof-of-concepts for edge-AI

In the short term, imec will centralize the research on edge-AI around three concrete use cases: anomaly detection, closed loop control and operator detection and tracking. In each of these scenarios, concrete proof-of-concepts will be developed over the next three years. Where possible, intermediate results should already be transferable to concrete industrial applications from the first year.

In order to bring all this, and possibly more, to a successful conclusion, imec can count on the cooperation of partners in the AI impulse program, such as the University of Ghent, the University of Antwerp, Flanders Make and KU Leuven. **Discover more details about these projects online (see URL and QR code on the cover).**



WHERE AUTOMATION ENDS AND ARTIFICIAL INTELLIGENCE BEGINS

The impulse program defines AI in four stages of increasing complexity. These are also the program lines that will guide the AI research in the coming years:

1. Supporting complex decisions: how can AI algorithms help to extract information from a complex dataset that you wouldn't notice (or not so quickly) as a human being?
2. Making own decisions in the edge: the moment when systems make their own decisions in a complex and changing environment. At a speed that does not allow information to be sent up and down to the cloud. So that the intelligence has to be created in the device itself (in the edge).
3. Interact autonomously with other decision-making entities: a stage in which AI systems that have been programmed independently of each other have to enter into a dialogue in order to figure out a suitable solution.
4. Seamless communication and collaboration with humans: there will be applications in which AI systems have to conduct complex reasoning with people and also have to process non-factual contextual information such as social behavior and cultural background.

Will AI take our jobs?

How can we make sure that AI systems – such as robots – will really help us and not take over the world and snatch our jobs away from us? Pieter Ballon, director of SMIT (an imec research group at VUB), emphasizes that engineers and social scientists need to work together on AI, because artificial intelligence is a technological innovation that will undoubtedly cause significant economic disruption and social changes. **Read his complete vision online (see URL and QR code on the cover).**

"Whatever happens, the content of many jobs will be changed by the arrival of AI. We will work with these AI systems and have to keep adjusting to new capabilities."

Pieter Ballon, director SMIT, an imec research group at VUB

Bringing AI to the edge

Today AI is successfully used to recognize faces and traffic signs, diagnose diseases and advance remedies, predict rainfall and consumer preferences, and much more. But doing so requires powerful, energy-guzzling processors. These sit at the heart of the cloud and require sensor data to be transferred all the way from where they are generated. Which is often prohibitive. The solution? Bring AI to the sensors at the edge of the Internet of Things (IoT). To do so imec researchers – like Diederik Verkest, distinguished member of technical staff at imec – are working on a pipeline of innovative hardware that instead of hundreds of watts consume less than a watt, or even mere milliwatts.
Read his complete vision online (see URL and QR code on the cover).

"There are use cases where patterns should be recognized instantaneously, such as with radars that need to detect people or vehicles in the path of a self-driving vehicle. There, the time delay of a round-trip to the cloud is simply prohibitive."

Diederik Verkest, distinguished member of the technical staff, imec

IN THE PICTURE: EASICS

Affordable AI in a box

Today's smart factories crave self-learning engines that make fast in-line decisions, close to the applications and sensors. Think of in-line quality control, factory automation, flexible robotics, automated sorting, etc. Such on-premise AI-engines need to be low-latency, energy-efficient, small and cost-effective. That's a combination of requirements that is hard to achieve with GPU-based cloud computing. What is needed instead is highly-customized yet affordable hardware with long-term availability.
Discover the AI-competences of Easics, an imec and KU Leuven/ESAT spin-off, online (see URL and QR code on the cover).

AI in industry 4.0: two angles to value creation

(Continued from cover story)....

From helicopter view to bottom-up action

SME- or innovation managers sometimes approach AI from a high-level strategic point of view, potentially embedded in an overall strategy for digital transformation. This type of exercise results in a broad analysis of the potential opportunities of AI and other digital technologies in their companies. And that is certainly a useful insight to have. Often then the difficulty lies in translating such helicopter analysis into a focus and approach for a first concrete application.

Especially for the optimization of internal business- and production processes, there are often quick wins to be made by – in a smart and structured way – looking at the existing datasets and workflows. And because these are usually already well optimized, the introduction of AI is often the best way to improve them even further.

AI for internal business processes

Two elements are important in this respect. The first is being aware of its own limitations. Flanders still has a lot of manufacturing companies in sectors such as textiles, pharmaceuticals, automotive, construction materials, machinery, etc. Such companies are experts in their own processes. However, they sometimes lack the technical knowledge to assess the value of their large datasets and a strategy to translate their process knowledge into, for example, a predictive model. Such companies can gain a lot by having an AI expert study their internal kitchen and unlock potentially latent sources of profit gain.

Secondly, it is important to always keep in mind the added value resulting from the intervention. For example, is it about reducing production costs, shortening turnover times, avoiding down-time or making the operator work better or safer? If there is no clear added business value, there is often little point in applying AI or any other digitization.

In any case, it is very useful to take a thorough look at the data that is already present in your company. Many companies log a larger amount of data than they are aware of. Maybe patterns or correlations can be discovered that make smart improvements possible? In addition to the deep-dive in large datasets, it is also important to invest in an IT-architecture that is suitable for managing these datasets and for providing the necessary computing power for machine learning models.

In general terms, such an approach can lead to immediate gains in terms of predictive maintenance, productivity, cost efficiency and product quality.

AI for new business models

Another AI-scenario can be applied to the development of existing products or services and their related business models. Take, for example, a company in the lighting industry for public spaces or industrial buildings. This sector already shows an evolution from offering a product (lamps) to a service (light). One step further is to look at all kinds of synergies that can arise with related sectors and/or data sources.

Think of safety (e.g. in parks), concentration (e.g. in schools), health (e.g. in rest homes), traffic flow (e.g. in cities), etc. Or what additional insights can emerge by including recordings of sound, images, etc. in your analyses? This is exactly what imec investigates in the Smart Zone project, part of City of Things in Antwerp.

Off-the-shelf technology

And there is already a wide range of immediately available technologies on the market. In collaborations with the industry - such as bilateral "customer-supplier" or funded ICON projects - it is often a matter of cleverly deploying and combining off-the-shelf technology. You can cover quite some distance with existing neural networks, available programming frameworks such as a Microsoft Machine learning studio, TensorFlow, and cloud- and hardware-computing platforms such as Azure cloud, Amazon AWS, and Nvidia DGX. Imec reaches out to companies with AI-related challenges as well as to those with a possible contribution to the answers.

IN THE PICTURE: IMEC.ICON PROJECT ARIA

Object recognition in augmented reality

In the framework of the imec.icon project ARIA, the project partners used artificial intelligence for object recognition. ARIA, a project that ran from 2016 to 2018, focused on the application of augmented reality (AR) for maintenance processes in industry. An important aspect in such a scenario is object recognition. More specifically, identifying the right parts and tools to perform a specific task. The AI algorithm was trained using a database of existing components, but can also identify and name new components based on their characteristics. Even if they were not in the original database. The ARIA project was a collaboration between MICT and IPI, two imec research groups at Ghent University; ETRO, an imec research group at VUB and the industrial partners Evonik Degussa Antwerp, Impala and Neopica. **Read the full article online (see URL and QR code on the cover).**

IN THE PICTURE

Smart spectrum management

As more and more wireless technologies (such as Bluetooth, Wi-Fi, IEEE 802.15.4, etc.) are operating in shared spectrum bands, cross-technology interference becomes more common. Your Wi-Fi might be disrupted when your microwave is switched on; the YouTube video on your phone may have trouble loading because your neighbor is using Wi-Fi to skype. In most contexts, delays and disruptions are merely annoying, but in an industrial environment they can be dangerous.

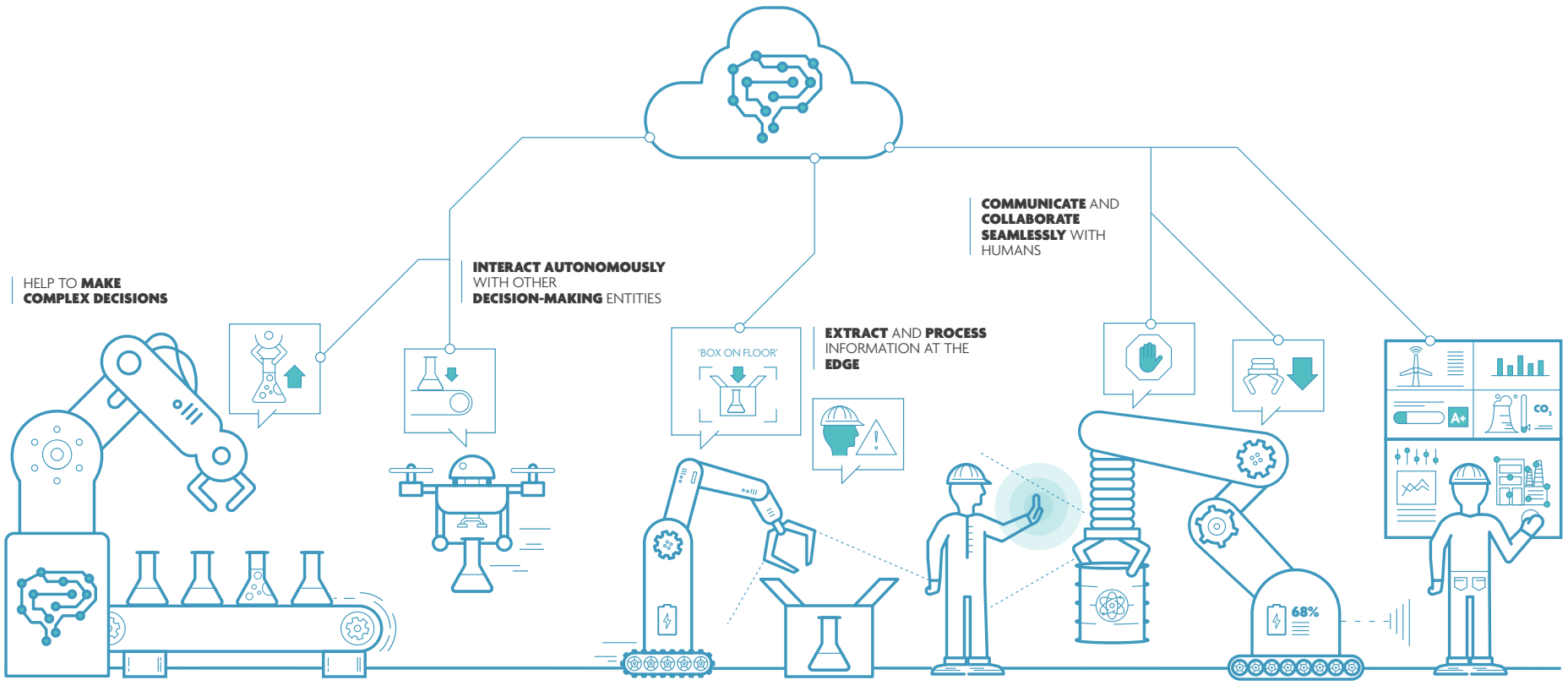
To tackle cross-technology interference, researchers from IDLab – an imec research group at the University of Ghent and Antwerp – have developed two machine learning solutions. First, they identify which technologies are in the air (technology recognition) and how they are using the available bandwidth (traffic recognition). The next step is to develop an algorithm for automatic finegrained spectrum allocation, which can ensure that the full potential of the spectrum is used and collisions are avoided. **Learn more about this project online (see URL and QR code on the cover).**

NEWS FROM 2035

Industry 5.0 test facility opens in the harbor

Yesterday, on the 23rd of April 2035, the petrochemical company Clean&Pure opened the very first industry 5.0 test facility in the world at its site in the port of Futureland. Within the designated area, the most advanced technologies are used to make the production and logistics processes even more optimal and safe. Since the introduction of industry 4.0, the complexity on industrial sites has increased enormously. With drones, autonomous vehicles and all kinds of automated processes running in parallel to a high level of human activity. In fact, Clean&Pure not only has to ensure the safety of its own employees, but also that the whereabouts of subcontractors, visitors and suppliers are accurately mapped and harmoniously integrated into the high-tech environment.

The central element of the test facility is a digital twin of the physical site. In this virtual environment, all physical elements are accurately replicated and adjusted in real time according to the dynamic situation. Thanks to various sensors, radar and camera technology, the digital twin can continuously adapt to the real environment. And, where in industry 4.0 this was still one-way traffic, in version 5.0 this can be done in two directions. The virtual environment can now also be used to instruct and control the people and devices in the physical test facility. And, thanks to real-time simulations predicting potentially undesirable or risky scenarios, it can also initiate timely action to avoid them. Clean&Pure will be experimenting in the test environment over the next six months and will then roll out the technology across all its sites worldwide.



Reducing the risks of premature births

(Continued from cover story).... What makes the system unique, is that it not only takes the structured data from the medical records (temperature, blood pressure...), but it also analyses the unstructured data (doctors' notes). Which is far from straightforward, since not every doctor documents his findings in the same way. For example, some write everything in full, while others use abbreviations. By combining the information from structured and unstructured data, the best results were achieved. The accuracy of the predictions, compared to non-software-assisted ones, was increased by ten percent or more.

The collaboration between the physician and the algorithm remains vital. Both of them make a prediction and the cases in which they disagree are the most interesting ones. The algorithm is transparent and indicates which data it uses to draw its conclusion. It is then up to the doctor to look at this AI-reasoning and make the final decision. This way, a two-way learning is established. Doctors are provided with more knowledge, which can help them to more quickly and correctly assess potential premature birth and handover the patient in case the delivery has to take place in a specialized center. The other way around, they improve the algorithm by correcting it when their personal experience prevails over the reasoning and conclusion of the software.

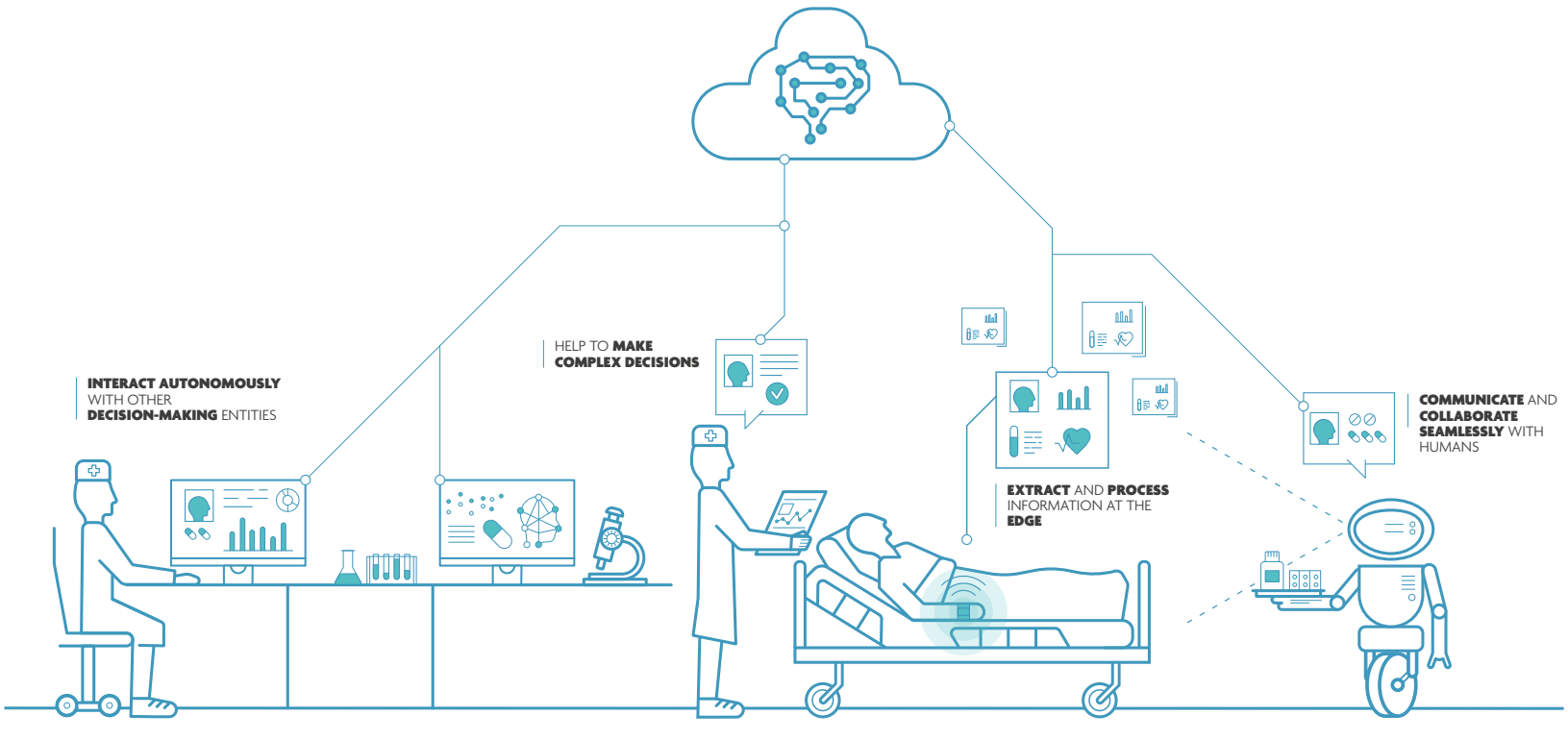
The project is a close collaboration between IDlab, an imec reseach group at Ghent University andthe Ghent University Hospital (UZ Gent). The current software was successfully applied to an existing dataset of past premature births. This made it possible to test the accuracy of the predictions because neither the doctors involved nor the algorithm were informed of the outcomes in advance. In a next step, the predictive power will be tested with new patients and therefore also with an unknown outcome for the researchers. Also, IDLab is exploring a collaboration with East Limburg Hospital (ZOL) and imec spin-off Bloomlife, which has developed a wearable for home monitoring of contractions. Together they will investigate if the sensor data of this wearable can further improve the accuracy of the AI-algorithm.

Accurate, personalized and predictive healthcare within reach

How can we live a healthy life for longer? And what are we going to do to tackle the ever-increasing cost of healthcare? By gathering more data about our health, making predictions about how our health will evolve and by working with our doctor to make the right choices for a healthy life. Perhaps we'll even be paying a 'personalized' premium for our health insurance – just as we do now for our car insurance. Although technology and artificial intelligence will definitely play a major role in this story, legislation and other regulations will have to ensure that this is a positive story, emphasizes Peter Peumans, senior vice president life science technologies at imec.
Read his full vision online (see URL and QR code on the cover).

"Making informed decisions about our health will mostly be left in the hands of doctors and specialists. Just as you would with a portfolio of shares. You may be very interested in those shares and how they are doing, but you'd probably prefer to leave most of the work to the experts so they can track everything in detail and take the right decisions."

Peter Peumans, senior vice president
life-science technologies at imec



IN THE PICTURE: IMEC.ICON PROJECT GAP

Clinical genomics affordable for daily use in hospital

The seven partners in the imec.icon GAP project revealed their unique genome analytics platform that can perform a full genome analysis of 48 samples in only 48 hours and at an acceptable cost. The platform paves the way to genome sequencing as a daily practice in hospitals, for diagnosing and treating genetic diseases, including cancer and rare diseases, and for better treating newborns with complex disorders.

Today, the 1,000-dollar genome is almost a reality. However, it is clear that just cost-efficient sequencing is not the whole answer to realizing personalized medicine. Turning the raw sequencing data into 'knowledge' and useful information for doctors, requires a lot of computing and storage power. Previously, the analysis and storage of the genome data had been too expensive and could take up to several weeks. Also, up until now, there was no real ecosystem or workflow available for clinical genomics, and discussions were ongoing on whether local or cloud computing were the best answer. This new hybrid platform, combines the best of both worlds: cost-effective analysis at a local site, and faster analysis involving cloud computing. **Discover more details of this project online (see URL and QR code on the cover).**

NEWS FROM 2035

Patient cured of life-threatening disease that affects only three people worldwide

In the University Hospital of Futureland, a patient has been cured of Hypotheritis, a rare but life-threatening condition. The disease, which affects only three people worldwide, progressively affects the nervous system, causing patients to suffer continuous pain and is ultimately fatal.

The disease is very similar to a number of other conditions and it is thought that a several people have died of Hypotheritis in the past because they did not receive the right treatment in time. However, thanks to the most recent diagnostic support software, the doctors of the UH Futureland were able to give the patient the correct treatment on time. The software, based on artificial intelligence, linked the patient's personal medical record to a worldwide database of anonymized patient records. It found a dozen matching diseases, and the outcomes of their potential treatments. From the proposed diagnoses, the doctors were then able to select the right one quickly. A good example of how human experience and artificial intelligence reinforce each other.

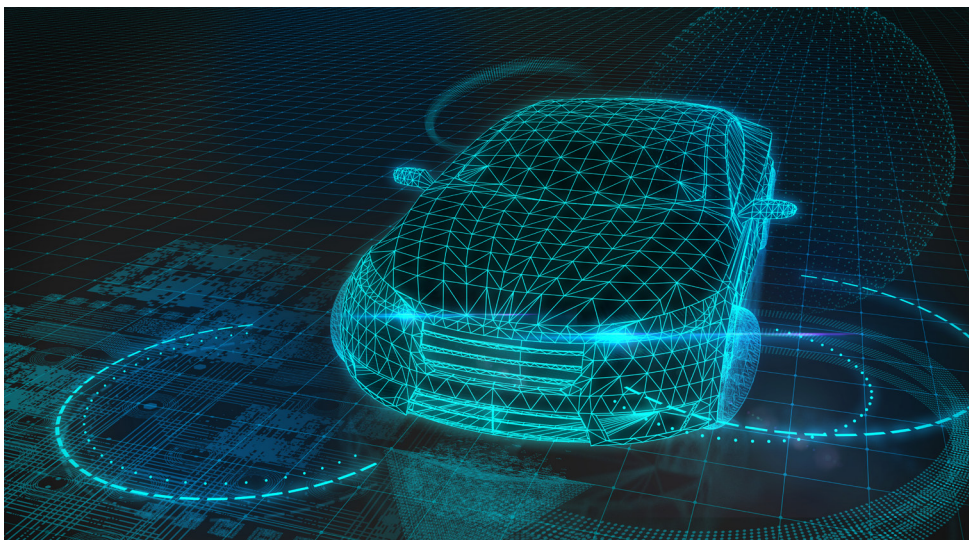
Radar and video: a cooperative method for sensor fusion

(Continued from cover story)... Each kind of sensor technology (e.g. radar, video, LiDAR, ultrasound...) has its own limitations. For instance, cameras don't work well at nighttime, or in dazzling sunlight. And radar can be confused by reflective metal objects, like rubbish bins or soda cans. Fusing the output of these different sensors is thus very important for accurate object detection.

Currently, sensor fusion usually happens at a relatively late stage, after each sensor has performed object detection based on its own limited collection of sensor data. In this way, a lot of sensor-fusion potential is lost, especially in circumstances where one sensor underperforms compared to another. To mitigate this effect, researchers from IPI developed a cooperative fusion approach that adds an extra feedback loop: the processing pipelines of different sensors already exchange low or middle level information. In this way, sensors can resolve ambiguities in their own detection process, resulting in better data association at the object level and improved tracking performance.

Not only is this method much more powerful than the late object level fusion that is commonly used today, it also easier to implement, validate and homologate than the holistic approaches suggested in academic literature, which consider all information from all sensors all the time.

Though smart vehicles might be the most obvious for this technology, accurate sensor fusion is actually also important in many other areas, e.g. smart intersections, retail analytics, surveillance etc.



From self-driving car to smart-mobility system

Self-driving cars, sharing scooters, Uber, overnight deliveries via online retailers: mobility and logistics are possibly the sectors with the most visible pursuit of disruptive technologies and business models in the last few years. Jan Adriaenssens, director of City of Things at imec, looks a few years ahead on this evolution and the role that artificial intelligence can play in it.

From a technological point of view, smart mobility is a combination of an advanced mobile and fixed infrastructure. Think of self-driving cars, but also smart traffic lights. There is also a distinction to be made between autonomous and connected systems. An autonomous self-driving car or smart traffic junction bases its behavior on the data from its own cameras and sensors. A connected vehicle or traffic-management system (also) receives information from sensors from other vehicles or from the environment. It is only when all these elements have been sufficiently developed and harmonized that we can really talk about a smart-mobility system. Or in technical terms, a Cooperative, Intelligent Transport System ("C-ITS"). **Read this complete vision online (see URL and QR code on the cover).**

IN THE PICTURE: CITY OF THINGS – DIGITAL TWIN

Gifted digital twin

Ask a person to play a computer game from the 80's that he has never played before and after 10 minutes he will reach a decent level. AI systems that are confronted with a new game take almost nine hundred hours to do so. After which they are instantly much better than any human player. But for now the learning process that AI needs remains an Achilles heel. Where nine hundred hours of playing computer games or searching through digital data could still be realistic, it becomes more difficult to have a self-driving car spend nine hundred hours learning in a real traffic situation. In such cases, where the real context imposes restrictions on the use of immature AI systems, virtual twins can come to the rescue.

At the end of 2018, imec and the Dutch innovation institute TNO launched a 'digital twin' of the city of Antwerp. This digital 3D replica of the city combines data on noise pollution with real-time sensor information on air quality and traffic, and computer models. It offers an up-to-date and predictive overview of the situation in the city, which can be used to simulate and test the impact of planned policies and interventions. **Discover more details about this project online (see URL and QR code on the cover).**

IN THE PICTURE: SMART HIGHWAY PROJECT

'Smart Highway' test shows how cars can work together to avoid accidents

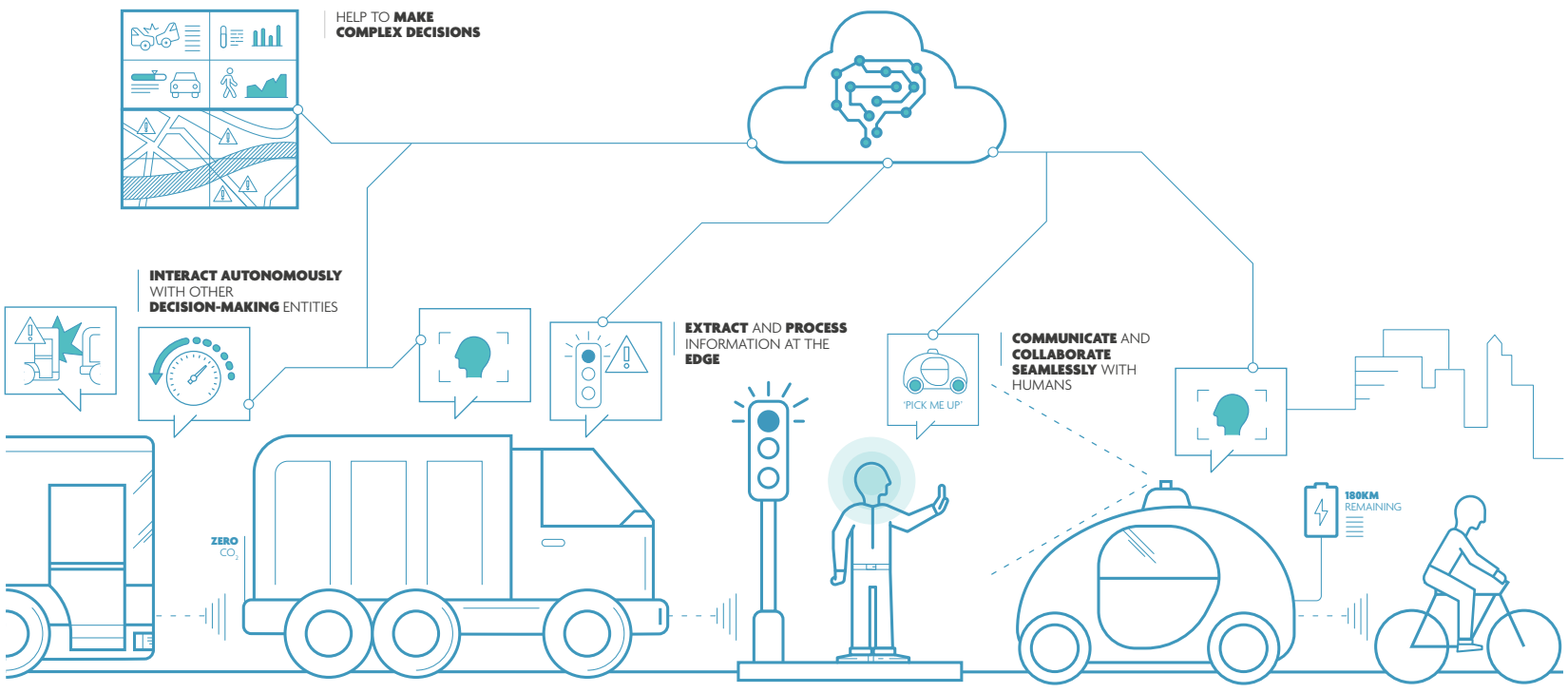
On 8 April 2019, imec, together with Antwerp and Ghent University, performed a unique real-life test with two connected and collaborating cars on the new Smart Highway test infrastructure along the E313 highway in Belgium. During the test, three cars drove in a row. Two of them were equipped with radio modules, while in between there was an ordinary car. When the first car made an emergency stop, this information was quickly passed on to the other equipped car, even if the normal car was between the two connected cars, or if it was out of sight of the first car. The second connected car was then immediately alerted to brake or stop. The aim is to use this type of information as an additional source of data to control self-driving cars in the future.

Smart Highway is a project of the Flemish government and runs in parallel with the European CONCORDA project. Both projects are coordinated in Flanders by imec and Antwerp University, with Ghent University, VUB, KU Leuven and Flanders Make (Smart Highway only) as research partners, and Toyota, Ericsson (CONCORDA), BMW, Telenet and Septentrio (Smart Highway) as associated partners from industry. From Europe there is a parallel initiative with CONCORDA in countries such as the Netherlands, Germany, Spain and France. **Discover more details about these projects online (see URL and QR code on the cover).**

NEWS FROM 2035

Near collision: self-driving cars get software update

Yesterday, in the centre of Future City, a near-collision took place between a self-driving car and a truck. The car suddenly had to avoid a broken branch that had fallen from a tree on the road, started to slip and thereby skimmed past a truck coming from the opposite direction. An exceptional event, as the number of accidents in Future City has been reduced to 1 per month since the introduction of self-driving cars. The whole scenario was recorded and analyzed by the AI-supported infrastructures in the car and the traffic center. As a result, all self-driving vehicles on the territory of Future City were given a software update in order to be able to deal with similar situations.



Where companies can go for help

Coordinated by the Flemish Agency for Innovation and Entrepreneurship (VLAIO) and the Flemish department for Economy, Science and Innovation (EWI), the partners in the AI impulse program are actively supporting the translation of knowledge and research into concrete added value for the (Flemish) industry.

To do this effectively, no new programs will be set up, but the existing instruments will be used with an increased focus on projects with an AI aspect. Some of these instruments are generic and target an entire sector or a larger number of companies. Others are partnerships between a small number of companies, with or without knowledge institutions. Others allow specific support to be offered to one company or are specifically aimed at spin-offs and startups

For more details, please visit the imec and VLAIO websites, or contact ai@imec.be.

Fewer work-related accidents

A good example of efficient co-operation between people and machines is the 'cobot', or collaborative robot, developed to assist Audi production line workers in assembling cars. Whereas previously these types of machines used to be placed in safety cages, the cobot is able to safely perform certain actions close to and with the help of its human workmates. This means that tasks such as applying adhesive can be carried out much more precisely, consistently and always in the same way. Meanwhile, the cobot's human workmate is able to control and direct it using hand gestures.

In the mining industry, Joy Global's Longwall Mining System is used to dig underground virtually automatically, without any human input. Staff sitting in the control room above the ground keep a close eye on everything going on and only send engineers below ground if it becomes necessary. So, for the sake of people's safety, mining has evolved to the most advanced stage of autonomy – although people are still very much a crucial factor of operations.

And there is more

In addition to technological research, imec and the partners in the AI impulse program are also working on related activities:

The AI barometer. Based on the results of an online questionnaire, imec will make a report available on the adoption of AI in the Flemish (business) landscape.

AI-experience centres. Physical hubs will be set up at various locations in Flanders where companies can come into contact with the possibilities of AI.

Think tank for AI and ethics. A group of specialists from academia and industry will specifically address the ethical and moral aspects of AI.

Outreach and training. There will be various possibilities for training on AI. Accessible to companies and a wider audience. For example, imec is already working with some partners to teach students the basic principles of machine learning.

AI touches nearly every aspect of work and life. Here are some other examples to stimulate the discussion.

The utilities sector will create more efficiency gains by combining market behavior insights with accurate demand forecasts and real-time monitoring and control systems.

Smart homes will increasingly be occupied by robot companions that perform day-to-day tasks and interact naturally with their users.

Social networking companies are under pressure to better monitor inappropriate and illegal content on their services.

Precision farming could benefit from AI innovations to increase yields and reduce pollution.

B2B and B2C companies invest a lot in customer relationship management, recommendation systems and personalization.

Biotech companies increasingly rely on high-throughput data to deepen their knowledge of biology.

Media and entertainment companies can rely on AI for assistance in the creative process (such as composition).

Creative industries are looking at human-level intelligence to enrich systems for architecture and product design or journalism, entertainment and education.

Smart buildings react to the behavior of their inhabitants. Conversely, these inhabitants need to understand the behavior of the AI.

The Tower of Babel: Human-like AI

In 1950, legendary scientist Alan Turing designed a test to investigate whether a computer could ever match the level of human reasoning and communication. The concept is simple. A human jury interviews an unknown opponent to determine whether they are dealing with a human being or a computer. If a computer program is able to deceive more than thirty percent of this jury, it passes the test. In 2014, two programmers, Vladimir Veselov and Eugene Demchenko, reached the global news when their chatbot, called 'Eugene Goostman', had for the first time in history been able to mislead a third of the jury of the Royal Society in London.

By now, chatbots and digital assistants are fairly well established in commercial services and consumer applications. Nevertheless, there is still a lot of work to be done in the domain of Human-like AI. Steven Latré, director of IDLab, an imec research group at the University of Antwerp, gives an insight into the shortcomings and how they can be eliminated. **Read his complete vision online (see URL and QR code on the cover).**

"As human beings, we know there's little chance a toddler will ask for porn. It's just common sense. Something every person has, at least to some extent. And that's exactly one of the things we also want to teach AI systems."

Steven Latré, director of IDLab, an imec research group at University of Antwerp

Imec research focus

Three proof-of-concepts for man-machine communication

To ensure the research on Human-like AI is geared as much as possible towards applicable technologies, imec defined three proof-of-concepts. These should lay the foundations for concrete solutions and for more widely applicable knowledge and technology. The three use cases are: understanding the context around vehicles, complex in-car dialogues and the AI-assisted operator. The initial focus of these scenarios has been defined for three years, with intermediate results that must be transferable to the industry from the first year onwards.

To realize these proof-of-concepts, disciplines such as Natural Language Processing, Computer Vision, Cognitive Architectures, Reinforcement & Fast Learning and Recommendation Systems come together. To this end, imec works closely with partners in the AI impulse program, such as the University of Antwerp, KU Leuven and VUB. **Discover more details about these projects online (see URL and QR code on the cover).**

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