For integrators, OEMs and suppliers using machine vision
The AI issue
Autumn 2025

IMAGING & MACHINE VISION EUROPE

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- On the Edge: closing the sensor-to-processor gap
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Can intelligent vision make our skies safer?

Regulators may face calls to reconsider vision-based monitoring

Online panel discussion catch-up

SEA.AI's Philipp Stampfl, So y's Faisal Kamran and NACL's Brian Wilson explore how non-visible light is transforming industrial imaging

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IMAGING & MACHINE VISION EUROPE

Autumn 2025

A must watch

How non-visible light is revolutionising industrial imaging

From quality control of silicon wafers to detecting bruised fruit or preventing maritime collisions, non-visible light wavelengths offer transformative imaging opportunities. Our expert panel discussed some of these applications and the challenges in implementing them

Read more on page 26

It's time to take vision-based cockpit monitoring more seriously after Air India crash

In the wake of recent high-profile air disasters, experts are advising airlines and other high-risk workplaces to employ intelligent vision solutions to track human activity

In the aftermath of the tragic Air India crash, aviation regulators and industry leaders are calling for advanced safety measures – with intelligent vision at the forefront. Experts now contend that tracking human activity in cockpits and other high-danger workplaces could provide crucial insights to help prevent accidents.

Rising demand for cockpit surveillance

Aviation research has long explored tracking pilots' gaze and hand movements. The EU-funded Peggasus project, led by the Swiss Center for Electronics and Microtechnology (CSEM), deployed dashboard-mounted cameras that track pilots' eye movements and recognise hand gestures in real time.

"We have developed an algorithmic pipeline that combines data-driven and analytics approaches to accurately detect eye gaze in real time and with minimum latency," said Sarah Saeedi, project manager for CSEM on Peggasus. State-of-the-art computer vision and machine learning techniques are used to detect the pilot's face, then localise several landmarks on it and around the eyes. The result, published by an EU commission-backed research report, is a multi-camera vision system with a gaze detection accuracy better than one degree at 60fps.

"The system addresses the unique challenges encountered in aeronautical situations, such as extreme variations in light intensity," said Andrea Dunbar, the project's CSEM coordinator.

"It improves pilots' situational awareness, and, consequently, decision-making, and makes it easier for the flight crew to work with aircraft controls."

Discussing human-machine interfaces that incorporate intelligent vision in aviation, Lufthansa Group's head of aviation training development, Gilad Scherpf, said: "Based on many incident and accident analyses, the highest degree of flight safety can be obtained. Any steps towards improving such an interface will be of great value to Europe's avionics industry.

"What's more, these interfaces can improve both flight operations and pilot training. Computer-assisted technology such as the one used in Peggasus can be very effective in modern airliners, especially since air-safety levels will need to be maintained or increased as the degree of automation increases."

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Adding video footage to black box recorded data could provide further insights into crashes

Seeing Machines

Eye-trackers could form fatigue detection systems in cockpits

Not just theoretical, these systems have already reached certification-ready levels. Australia's Qantas airline has already integrated Seeing Machines' eye-tracking tech into its Boeing 787 flight simulator to study attention patterns and fatigue, for example

"Based on our profound understanding and application of human factors science, this initial capability will support pilots and crew for the foreseeable future – perhaps more than 20 years across many different aircraft types," said Seeing Machines' chief executive Paul McGlone.

Behaviour analysis in wider workplaces

With regard to improving safety, intelligent vision isn't limited to aviation, of course. Industrial safety systems have evolved dramatically over the past few years.

"One of the greatest benefits of machine vision in the industrial environment is its ability to perform continuous, real-time monitoring of working conditions," said technology-based design and engineering solutions provider i-mas. Designed to monitor workers, machinery and the facilities themselves, machine vision systems can "detect risk situations before they materialise into serious accidents", explained the Spanish company.

In the construction and manufacturing sectors, meanwhile, safety solutions such as hard hats, fluorescent vests and easy-to access kill-switches are commonplace. But their use can often be forgotten. A research paper published by Huazhong University's School of Civil Engineering, for instance, suggests the use of computer vision to improve behaviour-based safety concerns.

Risks, privacy and operational hurdles

While the benefits are clea , so are the concerns. Technical limitations such as lighting variance, integration issues such as computational latency and compliance with privacy regulations are all hurdles that could hinder deployment. These challenges "necessitate ongoing innovation in machine vision technology," said consultancy Trident Information Systems.

"Compliance with regulatory standards is imperative for businesses deploying machine vision technology. From OSHA regulations to industry-specific mandates, adherence to standards ensures ethical and lawful utilisation."

Learning from Air India: a spotlight on cockpit video recorders

Although preliminary investigations into the Air India accident suggest human error might have played a role, mechanical data alone can't confirm the context surrounding any potential cognitive lapses or situational misjudgment.

Here, intelligent vision could fill a gap – by providing objective logs of pilot attention and decision-making, alongside video footage, in the moments leading up to an incident.

Following the 1999 Egyptair Flight 990 disaster, the Egyptian Civil Aviation Authority disputed the "use of selected facts and speculative conclusions" made by the US National Transportation Safety Board (NTSB) in its report.

As reported by *The Air Current,* NTSB's then-chairman Jim Hall said that "the origins of the actions, as well as the circumstances prompting the actions, that resulted in the changes in the aircraft's controls may never be definitively resolved because of the lack of electronic imaging of the cockpit."

The NTSB report recommended that the Federal Aviation Administration (FAA) "require crash-protected imaging recording systems be installed in all commercial aircraft by 2005".

And yet, more than 20 years past this deadline, although video recording technology is both ubiquitous and advanced enough to provide autonomous inspection in other sectors, it is yet to be a requirement in commercial aircraft.

Possible reasons for this lack of movement include privacy and security, but overall, cost.

As suggested by *Simple Flying,* "the FAA does not want to mandate that operators install such devices", and were, it seemed, unsupportive due to the additional costs it would pass on to airlines, estimating the total cost to the industry to be as high as $180m – all for benefits that, it was decided, could not be quantifie

The path ahead: merging tech and ethics

With the Air India tragedy as a wake-up call, the NTSB will likely renew its stance that the next evolution of aviation safety must cover the monitoring of human action, not just machines, arguing that regulators across aviation and industrial sectors must reconsider mandates for vision-based monitoring, used to complement black box flight data. **James Wormald**

Imaging sector braced for US tariffs Who escapes and who pays the price?

European Commission

European Commission President Ursula von der Leyen and US President Donald Trump

The US government's enforcement of retaliatory tariffs as of August 1 has caused major upheaval in the imaging and vision systems sector. While some countries negotiated deals to reduce or delay duties, many did not – and their exporters now face tariffs ranging from 15% to 50%. In comparison to other advanced technology sectors such as automotive and semiconductors, vision system components could be especially exposed, threatening competitiveness in the North American market.

For the European Union, a trade agreement with the US locks in a standard 15% tariff on most goods, with specific exemptions fo semiconductor equipment. For vision systems embedded in chip production tools – such as lithography alignment or wafer inspection modules – this could provide some insulation.

However, European imaging firms not directly serving semiconducto fabs – such as those producing scientific cameras, industrial i aging modules or microscopy equipment – will be hit by the full 15% import duty into the US. European Commission President Ursula von der Leyen emphasised that the agreement delivers predictability, but acknowledged that further negotiations would be needed to broaden the list of exempted items.

Meanwhile, the UK government also secured a high-profile agreem nt with the US that slashes tariffs on auto and aerospace sectors. However, there was no mention of any relief for vision systems, imaging sensors or optics further than the baseline 10%.

"Today's announcement is a huge win for aerospace," said ADS CEO Kevin Craven. However, for vision firms – many of which serve bot industrial and medical markets – there is less comfort. But with the 10% rate better than that forced on many local competitors, and far better than others further afield, this may finally give firms an oppo nity to plan for the future.

… for more on how the imposed US tariffs will affect other countries and regions, read the full story on imveurope.com

Cognex

Cognex assembles new team to drive AI-based machine vision strategy

A new executive leadership team has been formed by industrial machine vision vendor Cognex Corporation, under the direction of the US company's recently appointed CEO Matt Moschner.

To simplify deployment of its product portfolio, the company has tasked the team with accelerating a new long-term growth strategy based on artificial intelligence (AI), customer experience and market expansion.

According to Cognex, these three core priorities include becoming "the number one provider of AI technology for industrial machine vision; delivering the best customer experience in the industry and doubling (the company's) served customer base over the next five years"

"With this team in place, we are well-positioned to execute with speed, precision and innovation," said Moschner. "Together, we will drive the Cognex profitable growth agenda, deliver even greater value to our customers and invest boldly."

The team includes: Carl Gerst – Executive Vice-President, Global Sales & Products; Reto Wyss – Vice-President, Vision Engineering; Shirin Saleem – Vice-President, Software Engineering; Richard Reuter – Senior Director, Hardware Engineering; and Darren Long – Vice-President, Customer Success.

Donatos Pizza

Inside the autonomous Donatos pizza restaurant at Columbus Airport

Vision-guided autonomous pizza restaurant opens at Columbus airport

A fully autonomous pizza restaurant has opened at Ohio's John Glenn Columbus International Airport. Operating around the clock, the Donatos Pizza restaurant relies on an AI-powered suite of robotics and machine vision to consistently deliver made-to-order pizzas, with no human kitchen staff involved.

The robotic kitchen uses a technical infrastructure that includes robotic arms and real-time image sensors to perform the high-precision food-handling tasks required, including dough preparation, topping placement, oven timings and packaging. According to Appetronix, a machine vision integrator involved in the project, the set-up enables the restaurant to serve "hot, fresh pizza, with unprecedented precision and efficiency"

"This is more than innovation," said Nipun Sharma, Appetronix Co-Founder and CEO, "it's a transformative leap for the QSR (quick service restaurant) space, setting a new standard for consistency, speed and customer satisfaction."

The autonomous pizza kitchen, which is similar in scale to a large vending machine, utilises imaging components to inspect each pizza for metrics such as sauce coverage and consistency, cheese coverage, topping distribution and final quality before it is served.

How fruit farmers can perform quality control without destroying the crop

Visible and near-infrared (VIS/NIR) spectroscopy is increasingly proving its worth in the agricultural sector, offering a non-destructive way to assess internal fruit quality.

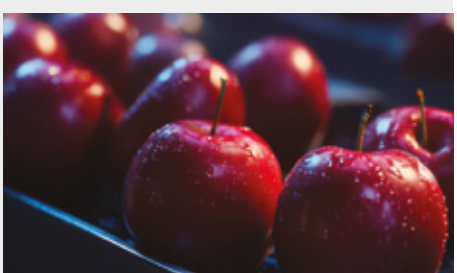
In a recent application note, Netherlands-based spectroscopy specialist Avantes showed how an AvaSpec spectrometer could be used, together with chemometric modelling, to estimate the soluble solids content (SSC) of apples – an indicator of sweetness and overall flavour – without destroying the sample in the process.

According to Avantes, "VIS/NIR spectroscopy provides a rapid, non-destructive means of evaluating fruit quality." The application offers advantages such as "minimising fruit wastage, reducing labour costs, and optimising processing efficiency".

The technique works by measuring how light interacts with the fruit's internal structures across the 600 to 1100nm wavelength range, with specific absorbance peaks – observed around 675nm, 760nm and 970nm – correlating with internal components such as chlorophyll, water and sugar levels.

In the simplified experimental set-up, apples were passed along a conveyor belt between a 50W halogen light source and a fibre-optic spectrometer system, which included a collimating lens and attenuator. Real-time data was then acquired that reflected the conditions used in commercial fruit-sorting environments, with each apple being scanned multiple times to account for natural variation.

To extract meaningful insights from the raw spectral data, the company employed chemometric analysis – specifically partial least squares (PLS) regression. The collected spectral data underwent a series of preprocessing steps, including baseline correction, smoothing with a Savitzky-Golay filter and normalisation.



Avantes

Avantes describes how VIS/NIR spectroscopy and image analysis combine to perform non-destructive internal quality assessments on fruit

Surge in demand for machine vision, but skills gap is slowing the roll-out, says Zebra study

The 2026 Warehouse Vision Study from Zebra reveals that 82% of European warehouse decision-makers believe technology and, specifically, automation will improve productivity, yet 57% also admit they don't know where to start.

Emerging as the top contender in the search for smarter, faster operations, 74% of warehouse leaders believed machine vision, along with fixed industrial scanning, could save time and reduce errors, while 65% aim to be adopting machine vision by 2030.

Furthermore, the high-spec imaging capability of mobile computers signals a move toward AI-augmented vision systems, where portable devices can assist by performing tasks that are traditionally handled by fixed-vision installations.

The report's broader data suggests the rise of machine vision is not alone in the move towards automation, with 60% of operators planning to implement AI, 64% augmented reality and 63% predictive analytics before 2030, with inventory management (79%), picking accuracy (79%) and quality control (71%) identified as the largest operational targets.

Phil Sambrook, Transport and Logistics Vertical Lead, EMEA, Zebra Technologies, suggests the digital overhaul is about talent retention: "Nearly 80% of warehouse decision-makers," he says, "agree that innovation makes warehouse jobs more appealing."

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A to Type-C M/M

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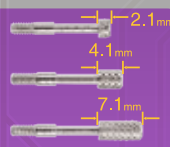


CBL-32PU3.1G1XH(L)-0.1m ~ 2.0m

Left & Right

CBL-32PU3.1G1XS-XmLRA

Up & Down

CBL-32PU3.1G1XS-XmUDA

A to Micro-B M/M

PASSIVE CBL-32USPD302MBXS-0.1m ~ 2.0m

CBL-32USPD302MBXH(L)-0.1m ~ 2.0m

Left Angle

CBL-32USPD302MBXS-XmLA

CBL-32USPD302MBXH(L)-XmLA

Up Angle

CBL-32USPD302MBXS-XmUA

CBL-32USPD302MBXH(L)-XmUA

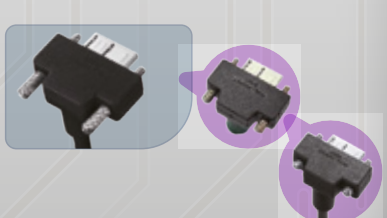
Right Angle

CBL-32USPD302MBXS-XmRA

CBL-32USPD302MBXH(L)-XmRA

Down Angle

CBL-32USPD302MBXS-XmDA



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A to Type-C M/M

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CBL-43AU3.1G1XH (L)-3.1m ~ 12m

Left & Right

CBL-43PU3.1G1XS-XmLRA
CBL-43AU3.1G1XS-XmLRA

Up & Down

CBL-43PU3.1G1XS-XmUDA
CBL-43AU3.1G1XS-XmUDA

PASSIVE CBL-43USPD302MBXS-0.1m ~ 3m

ACTIVE CBL-43USD302MBXS-3.1m ~ 12m

A to Micro-B M/M

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Left Angle

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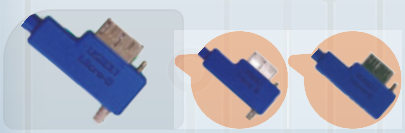

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CBL-43USD302MBXH(L)-XmLA

Up Angle

CBL-43USPD302MBXS-XmUA
CBL-43USD302MBXS-XmUA

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CBL-43USD302MBXH(L)-XmUA

Right Angle

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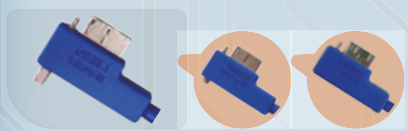
CBL-43USD302MBXS-XmRA



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Down Angle

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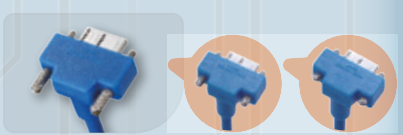

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Shell introduces pilot scheme to use robotic drones for industrial plant monitoring

Drone-based robotic plant inspection systems equipped with advanced machine vision technologies will be deployed at two energy facilities as part of a pilot scheme between Shell and Yokogawa Electric Corporation. Using imaging and sensing technology to improve the safety, accuracy and efficiency of asset integrity monitoring, as well as routine maintenance, the scheme involves integrating Shell's proprietary machine vision and AI analytics system, Operator Round by Exception (ORE), into Yokogawa's OpreX Robot Management Core software.

ORE was developed over two years through internal R&D and allows robots to perform autonomous visual inspections, says Shell, including tasks traditionally handled by humans such as gauge reading, leak detection and equipment condition assessment.

Yokogawa, a Tokyo-based industrial automation and control company with a long history in measurement and process technologies, sees the integration of ORE into its robot management platform as a strategic advancement toward fully autonomous plant operations. The company's OpreX Robot Management Core system allows users to manage and coordinate different robotic systems deployed across a facility.

Shell

Shell's North Sea offshore platform, off the coast of Aberdeen, Scotland

By connecting the software to a plant's control and safety systems, operators can issue instructions based on real-time data gathered from mobile robots. The system uses machine vision cameras and AI algorithms to analyse visual data, enabling real-time diagnostics in environments that are hazardous or hard to access. This reduces the need for manual rounds, potentially lowering operator risk and increasing inspection frequency.

The collaboration "promises to address the workforce challenges facing plant owners by significantly improving the efficiency of round in the field, while also reducing the inherent risk to operators," said Masaharu Maeda, ice-President and Head of Yokogawa's Solutions Business Division.

The pilot scheme marks the first formal project between the two companies since they started working together at the Energy Transition Campus in Amsterdam – a research and innovation hub established in 2022 to support collaboration on clean and efficient industrial technologies. "Robotics solutions combined with AI provide the potential to create a step change in productivity and safety," said Shell CIO Gerben de Jong.

Both companies are positioning the pilot collaboration as a practical step toward scalable autonomous operations – offering industrial users the ability to shift from manual inspection processes to real-time, data-driven visual diagnostics using autonomous platforms.

News from the EMVA
By Thomas Lübkemeier

In October the invisible becomes visible

"Imaging the Invisible" at the European Machine Vision Forum 2025 on October 16 and 17 in Fürth: This is the motto of this year's event, which has a particularly high-calibre programme. All speakers will address image processing technologies beyond the visible spectrum and their fascinating applications. Industrial image processing does not rely exclusively on images as humans know them. There are many ways to extend human perception: spectrally, for example, in the ultraviolet, infrared, or terahertz range of electromagnetic waves, as well as by expanding the colour channels in multi- and hyperspectral images, by using polarisation, or temporally by using high-speed imaging. Images can also be created using other imaging modalities, as is the case with thermography and acoustic imaging. In many areas, research has already reached concrete fields of application. These technologies are already being used in medical technology, aerospace, and industrial applications, as this year's European Machine Vision Forum at the host Fraunhofer Institute for Integrated Circuits IIS will impressively demonstrate. For more programme information and registration, visit www.emva.org.

Results of the ISO TC42-WG28 meeting

The ISO working group TC42-WG28 (formerly EMVA 1288) met in Berlin on June 26. The main topic was the transfer of the EMVA 1288 standardisation text to the ISO online platform for the development of standards (OSD). In a next step, the document will be opened for comments from all experts until the next meeting. The working group aims to publish the standard document quickly, with changes and additions to be made in a future revision. The next meeting is scheduled for October 14 at the Apple HQ in Cupertino, California.

EMVA market data outlook slightly improved

When viewed over the long term, the quarterly EMVA market data shows that image processing sales figures in Europe are still well below the peak values recorded in 2022. The analysis of the second quarter of 2025 also displays a decline in revenue compared with the previous quarter. On the other hand, companies' expectations for the coming six months have brightened considerably, with a majority of respondents expecting sales to rise again in future.

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Putting machine vision in focus: highlights from automatica 2025

Artificial intelligence, 3D imaging and precision optics dominate the automation landscape at this year's flagship robotics fair

Messe München GmbH

Held in Munich from June 24 to 27, automatica 2025 brought together 750-plus exhibitors and visitors from more than 100 countries, offering a sweeping view of how robotics, artificial intelligence (AI) and automation are reshaping industry.

For the imaging and machine vision sector, the event delivered both a spotlight and a stage. That stage came in the form of the Machine Vision Pavilion.

Co-created with the VDMA, the pavilion provided a focused platform for AI and Vision, 3D imaging, bin picking and robot vision, with deep-dive discussions at its Vision Expert Huddles.

Rather than remaining limited to its home space, however, imaging tech was everywhere to be seen across the fair – in real-time inspection, autonomous guidance and collaborative robot safety systems. For European manufacturers, vision is fast becoming the eyes of intelligent automation.

Fraunhofer institutes: vision at the cutting edge

A stand-out presence across the show, multiple Fraunhofer institutes demonstrated how imaging underpins automation – from cognitive robotics to sustainable e-waste recycling.

Here are some stand-out works, presented by Fraunhofer:

Fraunhofer IFF – smarter robots = safer workspaces

Fraunhofer IFF revealed AI-powered cognitive robotics that uses camera vision to recognise and adapt to unknown objects in real time – no pre-training needed. Meanwhile, the PARU safety system projects visible light curtains around robots, dynamically monitored by cameras to ensure human safety and compliance.

"Our technology is unique," said Norbert Elkmann of Fraunhofer IFF, highlighting its ISO/TS 15066 adherence. Also presented was Fraunhofer IFF's package of computer-aided safety (CAS) solutions, which further simplify compliance for collaborative robotics.

In the Machine Vision Pavilion

Messe München GmbH

> “We want to revolutionise the disassembly of e-waste”
>
> **Dr José Saenz, Fraunhofer IFF**

Fraunhofer IFF – vision-guided electronics recycling

Another development presented by IFF was its iDEAR project, which combines 3D imaging and AI to automate electronics disassembly. High-resolution cameras and spectral sensors scan devices to detect screws, classify materials and build digital twins for each product. According to IFF, this enables robots to execute precise, tool-changing disassembly – recovering valuable components from e-waste without manual input. “We want to revolutionise the disassembly of e-waste,” says project lead Dr José Saenz.

Fraunhofer IWU – imaging in motion

Presenting its GreenBotAI system that blends fast vision and energy-efficient robotics, Fraunhofer IWU explained how cameras are used to capture 3D images of moving components, which allow robots to handle and assemble without stopping. The robot predicts motion, selects grip points and inserts parts – like rivets – on the fl , guided only by visual data. Combined with real-time force analysis and a digital twin, Fraunhofer IWU says the set-up boosts both productivity and energy savings by up to 25%.

Fraunhofer IOF – seeing the invisible

goROBOT3D, a thermal imaging system that detects transparent, dark or reflective objects in less than two seconds, was presented by Fraunhofer IOF. Using a single pair of thermal images and diffractive optics, IOF says the system delivers high-speed 3D data, even on tricky surfaces. “Instead of capturing several hundred pairs of images,” says Dr Martin Landmann, IOF research scientist, “our method can reconstruct the 3D information with just one,” enabling continuous bin picking and handling without experiencing cycle interruptions.

Technology in the aisles: imaging highlights from industry exhibitors

Fraunhofer wasn’t alone in spotlighting imaging breakthroughs. Across the show floo , leading vendors brought practical, deployable solutions that push machine vision to new heights. Included were:

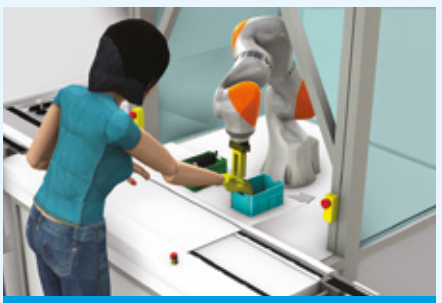
MVTec – vision software built for automation

AT MVTec’s booth, demonstrations of its HALCON, MERLIC and Deep Learning Tool platforms included solutions such as OCR, defect detection, barcode reading and Deep 3D Matching – blending traditional and AI methods for resilient bin

Messe München GmbH

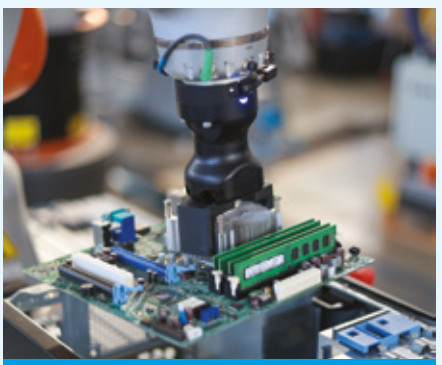
automatica 2025 ran from 24 to 27 June at Messe München

Fraunhofer IFF



Computer-aided safety helps planning, risk assessment and safety approval

Fraunhofer IFF



Robot lifts the motherboard out of the housing

Fraunhofer IWU

Guided by 3D data, the robot picks up a clip and inserts it into a moving part

picking. “AI for industrial machine vision is made in Munich,” said Dr Olaf Munkelt, the Munich-based company’s MD.

OPT – multi-angle imaging and AI precision

OPT Machine Vision showcased a range of inspection and guidance systems at the fair, including its 2.5D programmable pattern light system, which, it says, tackles reflective surface defects. Meanwhile, a showcased FPGA-powered 3D picking solution uses laser profiling and edge AI for rapid, sub-millimetre positioning. “Our solutions align with the precision demands of Western manufacturers,” said OPT, highlighting its role in advanced automotive and electronics inspection.

Vieworks – dual imaging and high-sensitivity cameras

Unveiling its latest dual imaging TDI line scan camera – the VTD-16K5X2 – Vieworks suggested it can half inspection time by capturing two images in a single scan. According to the company, the back-side illuminated VT Sense series enhances imaging across visible, UV and NIR spectrums, and co-developed lenses from Schneider Kreuznach complete the vision package for inspection environments.

Mech-Mind – high-speed AI + 3D vision systems

Including registration-free picking and DOT code reading, Mech-Mind’s AI + 3D vision demos at automatica were some of the most varied. The exhibitor revealed how its “Eye + Brain” systems uses structured-light and laser profilers to guide robots through a chaotic part-handling process with minimal training, and how its systems can deliver precise 3D imaging, even at distances in excess of three metres which is ideal for large EV parts and reflective surfaces.

ABB – AI vision driving autonomous robotics

ABB framed imaging as central to its “Autonomous Versatile Robotics” strategy at the fair, stating that vision systems now let mobile robots perceive, plan and re-plan tasks in unstructured environments. OmniCore, ABB’s new modular control platform, and its AI-enabled vision software were both on display in Munich, powering real-time autonomous picking, fault detection and Visual SLAM navigation with mm-level accuracy. “We’re combining all the senses robots need,” said ABB Robotics President Marc Segura.

IT+Robotics – 3D toolpath planning made simple

IT+Robotics debuted EyeT+ Adapt – a surface finishing system that uses 3D vision to auto-generate toolpaths for tasks such as grinding or polishing – at the fair, explaining how it “transcends the limitations of traditional methods”, according to CEO Stefano Tonello. Explaining how the system scans, then adapts to each unique workpiece, IT+Robotics says it eliminates manual programming, and enables flexible, high-quality finishing in low-volume or high-mix environments.

There was a lot to take in across four days of automatica 2025, but one lesson was clear: machine vision is no longer a supporting technology, it’s the driver of flexibility, safety and intelligence in next-generation automation. Whether they’re enabling robots to adapt, inspect or collaborate, vision systems are central to how we build, inspect and interact with machines. i

THE 2026 LIST
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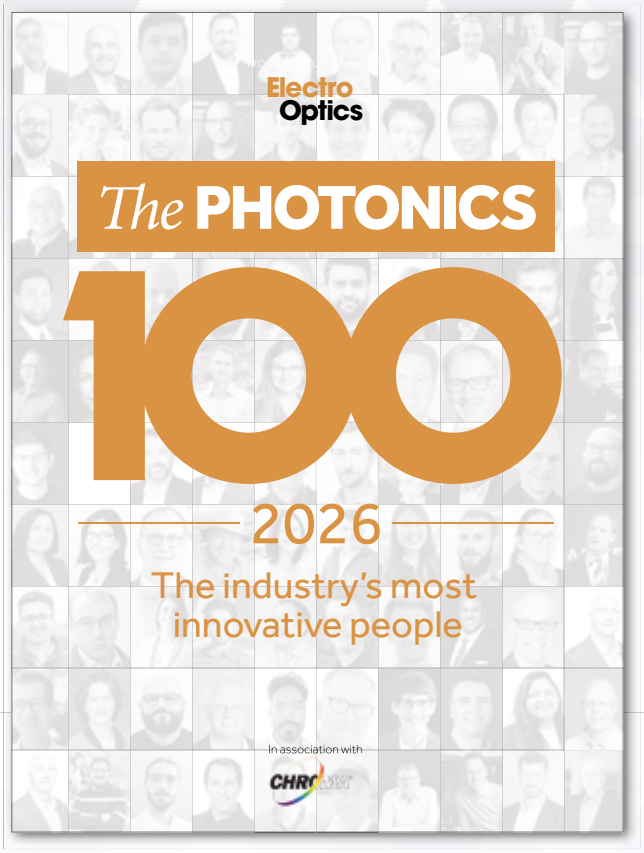

Introducing The Photonics100: The Movers and Shakers Transforming Photonics

Now in its fourth year, The Photonics100 shines a spotlight on 100 trailblazers nominated by the global photonics community - those who are accelerating innovation and shaping the future of photonics technology.

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visionaries

"The biggest challenge is bridging the gap between the desire for AI-driven imaging and its commercial viability"

42 Technology Director of Industrial Instrumentation, Jamie Jeffs, tells *Imaging & Machine Vision Europe* how the vision system integrator blends imaging with AI for bespoke, yet scalable, solutions

Imaging & Machine Vision Europe: Tell me about 42 Technology. How do you integrate imaging components or technologies into bespoke solutions?
Jamie Jeffs: 42T is a broad-range technical consultancy providing clients with solutions that require a science and engineering approach. We work extensively across industries to solve complex problems by developing bespoke sensing solutions, often involving the integration of vision and image acquisition systems within a wider system-engineered solution. This involves working collaboratively with vision system providers to integrate commercially available components, through to the full design and development of a complete optical system.

IMVE: Could you take me through some of the recent projects where you've applied imaging technology in an innovative way? What was the outcome?
JJ: With our recent collaboration with Balluff, Synaptics and Arcturus Networks, we identified an opportunity to leverag Synaptics' Astra range of edge AI devices to address issues with automated line clearance checks in pharmaceutical production processes. The challenge of scaling an automated vision system to provide AI-driven object detection involves balancing cost with performance.

By designing an integrated system that couples Balluff's industrial image acquisition systems with Astra's capability for edge image processing, we developed a platform from which cost-effective automated line clearance can be deployed on the edge, that balances the required IoT workloads with an automated imaging system with a commercially viable approach. The application is designed for manufacturers of high-volume/low-cost products that need multiple inspection points on multiple lines.

The system addresses a number of challenges which are barriers to deployment. By working with Arcturus Networks to deploy the data analytics at the edge, the system avoids the need for cloud connectivity and the associated data management costs and data security concerns.

The Arcturus deep learning models are

.42 Technology

Synaptics' AI-powered line clearance solution

able to provide on-premises model training, which further reduces the need for operators' data to leave site, and the open development environment provided by Synaptics enables the system to be customised for different processes in a quicker and less restrictive way compared with other solutions.

The system was designed with integration – alongside existing PLC and plant-wide automation systems – in mind, providing the capability to integrate with existing infrastructure but also adaptable enough to be implemented by machine builders or incorporated into a wider suite of software solutions. While focussed on pharmaceutical line clearance, this platform can be adapted to address a wide range of manufacturing processes that support defect or anomaly detection such as in the chemical, food and beverage and consumer health sectors.

Elsewhere we have supported the integration of custom vision systems into large-scale digital printing applications, high-speed cameras in transportation sectors and imaging systems for neonatal eye inspection to detect cataracts.

IMVE: When working with new clients, how do you deal with expectation management in terms of what a vision system can (or can't) do?

JJ: In our experience, managing these expectations is all about establishing the requirements in a structured way early on, creating a set of defined specifications that consider the actual deployment of the system in the application. Although it can be tempting to do some quick experimentation and prototyping of vision systems, unless you have properly understood the processes the system will monitor and the challenges it needs to overcome, it can often lead to re-engineering down the line, or in the worst cases, having an end system design that doesn't achieve the users' expectations.

This is particularly true with AI integration where the deployment is used to automate a process. Without fully understanding the role operators play in performing manual tasks – visual inspection, for example – implementing an automated solution can fall short of the full range of tasks performed manually, and leave operators still requiring the manual inputs they sought to remove.

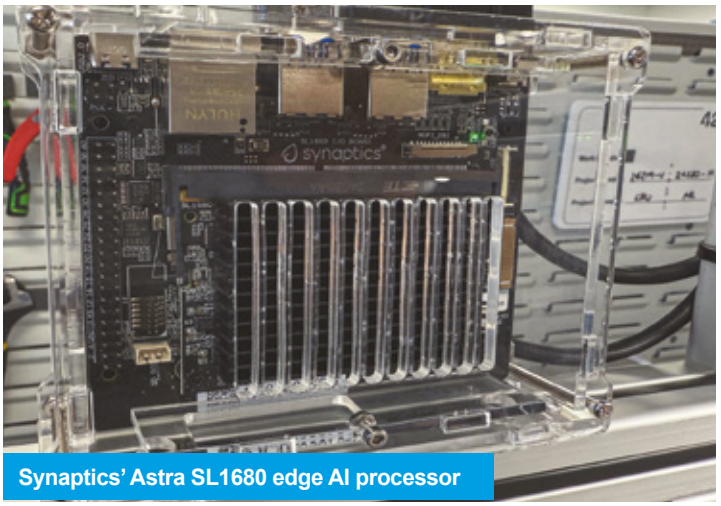
IMVE: What are your pain points when sourcing vision components and designing systems?

JJ: Common challenges in system design often centre around the interconnectivity of commercially-available hardware and the restrictive development environments of data processing solutions, particularly in industrial applications. While many OEMs provide a wide range of industrial comms, the complexity and associated costs of integrating bespoke solutions into existing PLC/DCS systems can often make scaling these solutions to multiple monitoring locations or across multiple manufacturing plants challenging.

Equally, some of the AI-driven solutions,

> "Some AI-driven solutions force users into restrictive development environments, locking them into system architecture"

Balluff's image acquisition system for line clearance



Synaptics' Astra SL1680 edge AI processor

either integrated into existing image acquisition systems or available as edge compute solutions, force users into restrictive development environments, locking them into system architecture with a limited development environment and relatively high costs of ownership, which can be a barrier to adoption.

Whilst this can be attractive for ease of configuration and use, the requirement in many cases is to transfer live streamed data directly into PLC systems or a standalone IT infrastructure for processing, which puts a further strain on the operator's internal data management solutions.

IMVE: What types of optical components do you buy?

JJ: At 42T we typically work on complex technical challenges that require bespoke solutions. As such we are able to individually consider the right approach for each project. This could include anything from designing and developing our own optical components right through to working collaboratively with existing vendors of complete image acquisition systems, and everything in between.

IMVE: What represents the biggest challenge in growing your vision-related business over the next 12 months?

JJ: The biggest challenge to growth is bridging the gap between the desire for AI-driven imaging solutions and the commercial viability of deploying them. Whilst there is an undisputed desire for greater automation in manufacturing, driven by AI vision-related technology, the relative geopolitical uncertainties make investment decisions challenging for industry.

Solutions that are easier to deploy than traditional large scale automation projects, and that show a return on investment more rapidly, will be attractive to industry. We see the potential for greater collaboration between companies like 42T and operators, OEMs, machine builders and AI device vendors as a way to achieve these more rapid and commercially viable solutions.

IMVE: In terms of how vendors can support you, what represents good customer service?

JJ: Vendors can support our needs, and the needs of our clients, by providing open platforms for rapid development. Along with the core requirements of responsiveness and high-quality technical support, the values we look for in vendors are less restrictive development environments to integrate their equipment.

IMVE: Where else could vendors improve?

JJ: A more open approach to pricing and subscription models for the products and services provided would help users understand the true cost of ownership.

IMVE: How do you set about finding new business opportunities?

JJ: We work with clients across the long-term, so provide support to a group of core clients across a wide range of science and engineering projects. We attract new clients by being actively engaged in these cross-industry challenges and defining ways in which we can help solve them. We also exhibit and attend events, publish articles and case studies and often receive referrals from current or former clients.

IMVE: How do you differentiate yourselves from your competitors?

JJ: With our experience in both solving complex challenges in industrial processes and developing new products for use within these industrial applications, we provide an insight to both process operators and OEMs that our clients find highly valuable. Our ability to understand the processes we are supporting with sensing and instrumentation solutions is a combination that sets us apart from many of our competitors.

IMVE: Which sectors are showing the most growth in machine vision, and why do you think this is?

JJ: We see significant growth across all the sectors we work in including industrial, MedTech and consumer. The drive for AI-based solutions to improve automation, process efficiency and quality control, in manufacturing in particular, requires data captured from sensing solutions such as machine vision. As OEMs and operators further explore real-world applications for IoT within their processes and/or products, the demand for commercially-viable machine vision systems will continue to grow.

IMVE: What do you think the next 12-24 months will hold for machine vision?

JJ: We see the emergence of more cost-effective and scalable edge computing solutions powering native AI solutions embedded close-to-the-sensor as a catalyst for further evolution of machine vision, addressing the current cybersecurity and data management barriers that prevent adoption in certain industries that use cloud-only solutions.

The advantages of lower power consumption, reduced latency and increased compute power for edge devices, coupled with advances in machine learning capabilities, will increase the demand for automation, further driving partnerships and collaborations with OEMs seeking complete scalable, and commercially viable, solutions.

IMVE: Are there any events you plan to attend or exhibit at over the next 12 months? How important is event attendance/exhibition to your business?

JJ: We will be exhibiting at GITEX Europe in Berlin in mid-May with further exhibitions planned for later in the year. We find exhibiting and attending events is an important part of our business as we continue to engage in person with a wide range of industry leaders, collaborative partners and other innovators to provide cutting edge solutions. i

Previous 'Visionaries' interviews with machine vision integrators can be found in the series archive at imveurope.com/visionaries

If government money doesn't advance a project, 'be honest and stop it'

EPIC's Antonio Castelo talks to Paul Ryckaert (right), CEO at Xenics and Executive General Manager of EXOSENS Advanced Imaging Business Unit, a French multinational specialising in high-end electro-optical technologies

Antonio Castelo: What's the background to your appointment as CEO at Xenics?

Paul Ryckaert: In 1992, after doing an MSc in Electromechanical Engineering at Ghent University (Belgium), and, in parallel, an MSc in Solid Mechanics at University of Manchester (UK), I started at Ford in Belgium, as a test engineer.

I then worked at Siemens in Germany for five years as a project manager fo connecting systems for mobile phones. Following the acquisition of Siemens EC by Tyco Electronics, I worked for Tyco, where I became Director of Engineering & Product Management for Communications, Computer and Consumer Electronics for three years.

In 2003, I moved to Barco, a Belgian multinational specialising in advanced display technologies, where I was responsible for worldwide development of the media business. Then, in 2011, looking for a more entrepreneurial path, I became co-CEO and co-shareholder of Team Industries, a sheet-metal manufacturing company operating in Belgium, Slovakia and Romania, where I managed production, engineering, purchasing and quality operations across multiple sites.

Finally, in 2016, I became Xenics CEO to provide fresh leadership and vision regarding the development of its range of infrared imaging detectors and cameras (with a big focus on SWIR, Short Wave InfraRed, InGaAs technology).

AC: How has the company developed?

PR: Xenics was set up in 1999 as a spin-off from IMEC to develop, produce and commercialise infrared sensors, cores and cameras. Since then, the company has steadily expanded across the vSWIR, SWIR and LWIR thermal imaging spectrum, for machine vision, scientifi and advanced research, transportation, process monitoring, safety and security, and medical applications.

In 2018, we upgraded our sensor manufacturing capacity – adding clean rooms and modern processing equipment, which also enabled us to improve our SWIR detector performance through lowered dark current and enhanced dynamic range.

By the early 2020s, we had grown to a workforce of more than 65 and become Europe's leading supplier of SWIR imagers with sales offices worldwide Looking to accelerate growth, we began to think about a merger to boost our product development, manufacturing competences and worldwide reach.

After considering a number of options, in 2022, we were acquired by Photonis Group (rebranded as Exosens the following year), a global leader in innovation, development, manufacturing and sale of high-end electro-optical technologies in the fields of amplificatio detection and imaging.

Following the acquisition, I stayed as CEO at Xenics and was also appointed Executive General Manager of Exosens' Advanced Imaging Business Unit, overseeing digital imaging and camera technologies across a broader spectrum.

AC: What were the main challenges when you started at Xenics?

PR: Like many start-ups, a major challenge was that, although Xenics had a lot of great technologies and products, there was no consistency or overlap between the technology development, the product and operational road maps and the commercial approach. In my experience, it's important that all these fields are clearly aligned to succeed I started by looking at the competences, products and markets, and assessing what the core competence and added value of the company really were. It was then possible to start making strategic choices; dispensing with some activities that were not core – for instance, mechanical development or high volume assembly – and finding companies in th ecosystem who could do it for us.

I also took time to assess the organisation – to attract experienced people to drive the growth of the company. I made some mistakes, but I think, overall, one of the reasons why Xenics developed successfully was that we very quickly identified th 'cornerstone' people in the organisation. We also secured the gaps by successfully recruiting outside talent and building a strong management team.

When I arrived, Xenics was involved in a lot of government-funded projects. But, in my view, funding for the sake of funding is not a good idea. For me, the question is: does the money bring the company further along its road and help society? If the answer is 'no', I think you need to be honest and stop the project.

AC: Why did you choose to be integrated with Photonis Group?

PR: There were a lot of parameters that influenced the decision. How was th market evolving? Were our customers and suppliers consolidating? Were our company cultures similar and our technologies complementary? It's a bit like house hunting – by seeing some different houses, you shape your ideas and your appetite, and you create a certain momentum.

Fortunately, we converged with

Xenics' Cheetah+ 640 CAM is built around a temperature-stabilised InGaAs sensor

Photonis Group, now Exosens, quite quickly. First, because there were a lot of complementarities in the technology spectrum: Photonis Group did not have any SWIR range, which Xenics clearly mastered. Second, there were a lot of similarities in terms of focus on innovative technology and sound business culture: a no-nonsense approach, keeping things simple; and third, we shared the same values in terms of management structure; i.e., making decisions at the lowest possible level and not creating a kind of huge corporate environment that, typically, delays things.

AC: Did you have any red lines in your negotiations with Photonis Group?

PR: I'm not a big fan of red lines because I believe the best way to make sure, for example, that your core competences are maintained is to clearly demonstrate that they are bringing added value to the customers and the company. If so, these competences will also be valuable for the acquiring party and there will be no discussion about it.

AC: How do you see the future of imaging technologies?

PR: What makes the photonics market so different and fascinating compared with the others I've been involved in are the endless possibilities. Every week, we see how different technologies, e.g., UV, solar-blind UV, near-infrared, low-light visible, intensified visible, short wave and uncooled long-wave infrared, cooled infrared technologies etc., are enabling new applications that were not possible before in areas such as the environment, biomed, free space optics and semiconductor inspection. It's just endless; to the extent that I think growth is a matter of saying 'no' to certain opportunities and keeping firmly aligne with your product and technology road map and carefully selected application focus areas.

AC: How do you see your competitors?

PR: It's good to have competition because it keeps you sharp. But we have our own mindset, our own clear course, and we are focusing on our own strategy rather than being too much diverted by looking at what others are doing.

AC: What's your advice for the next generation of entrepreneurs?

PR: One of the most important things I have learnt in my career is to surround yourself with the right people. I think you can only thrive in a business when you have the right world-class skills around you. Let's say like-minded people, but also diverging voices – provided they are all business-oriented and based on sound, objective thinking.

It is important to have the right people on the bus, because, together, you will determine in what direction – and at what speed – the journey will evolve… i

"I think growth is a matter of saying 'no' to certain opportunities and keeping fi mly aligned with your product and technology road map"

On the edge: closing the gap between AI and image sensors

Edge computing is bringing AI processing power closer to imaging sources, enabling split-second decisions. But implementing these systems presents unique challenges. Experts at one of our recent online panel discussions explored how organisations are overcoming them

As computer vision applications become increasingly sophisticated and data-intensive, the traditional approach of processing everything in the cloud is proving inadequate for many use cases. Edge computing has emerged as a transformative solution, moving data processing closer to the source to reduce latency, improve efficienc , and enable real-time decision-making capabilities that were previously impossible.

The shift towards edge-powered computer vision represents more than just a technological evolution – it's a fundamental reimagining of how we approach data processing in scenarios where milliseconds matter and connectivity cannot be guaranteed. From autonomous vehicles making split-second safety decisions to agricultural drones identifying crop diseases in real time, edge computing is enabling applications that simply couldn't exist with cloud-dependent architectures.

The challenges landscape

The implementation of edge computing in computer vision applications presents a unique set of technical and operational challenges that require careful consideration and innovative solutions. Understanding these obstacles is crucial for those looking to deploy effective edge-based vision systems.

Giuseppe Garcea, co-founder and HW R&D director at Axelera AI, outlines the constraints: "Edge devices operate with limited processing power and memory, compared with the cloud. So AI models you deploy must be optimised to run efficientl and on less expensive hardware. Second, the power envelope is a big constraint for those systems. Typically, they run on battery or physically. They are placed on boards, in a relatively small box. Third, AI models to be deployed are becoming more complex."

This convergence of limitations and increasing complexity creates what Garcea describes as a critical inflection point: "If yo put together those three facts, we are going into the direction in which we need more compute (power), more efficiency and more cost-effective solution. This means you need something new from a hardware point of view, and the CPUs and GPUs widely used today are probably not enough. So, we are going towards a space that is developing hardware accelerators for AI edge devices."

> "Forget about cooling systems based on liquid cooling that you have in the data centre. You will not have this at the edge"
>
> **Giuseppe Garcea, Axelera AI**

The technical challenges extend beyond processing power limitations. Model optimisation becomes critical when deploying sophisticated neural networks on resource-constrained devices. "When we think about a floating point neural networ that needs 100MB of model memory, quantisation is something you need to keep in mind if you are deploying at the edge. This calls for graph manipulation to prune some of the operation, to make it more efficien in terms of deployment into your chip compression data," Garcea explains.

Thermal management presents another significant hurdle. Unlike cloud data centre with sophisticated cooling systems, edge devices must operate within strict thermal constraints. "Forget about cooling systems based on liquid cooling that you have in the data centre. You will not have this at the edge. You will have active cooling, but you need to take into account that you have limited space," Garcea notes.

Connectivity issues compound these technical challenges. Garcea says edge devices often operate in environments with limited or unreliable network connections, requiring sophisticated data management strategies: "Think about models which, as interaction computes, go to the cloud or locally; you need to decide how to sync data correctly. So you need to manage what intermediate results that need to stay at the edge, or things that need to be shared onto the cloud, while taking into account that your connection cannot be reliable."

Complexities in edge computing

Beyond the technical challenges, organisations face significant operationa hurdles when deploying edge computing solutions at scale. Faisal Kamran, Principal Technology Analyst at Sony, says: "Unlike a single cloud data centre, with edge, you might have dozens of thousands of units out in factories, hospitals, or even outdoor locations. That means maintenance, such as updating software, monitoring performance and repairing units. This becomes a significant challenge requiring high reliability."

Data governance adds another layer of complexity, particularly for organisations operating across multiple jurisdictions. "Different regions have laws about very sensitive data, such as medical images and personal videos. The way they need to be processed can pose challenges, especially when operating across borders and between different regions," Kamran explains.

He adds that the skills gap is often underestimated as a challenge. "Blending expertise in embedded systems requires AI,

networking and cybersecurity power. While these are traditional IT terms, there's growing demand for engineers who understand the AGI speciality. This is not quite highly available," Kamran observes.

Edge applications in machine vision

Understanding where edge computing transitions from a nice-to-have to a necessity helps clarify the its value. Some applications simply cannot function effectively with cloud-dependent architectures.

Autonomous vehicles represent perhaps the most immediately compelling example of edge computing necessity. Kamran emphasises: "We see certain applications where you simply cannot rely on the cloud data due to latency, connectivity or privacy, and these absolutely require edge processing. A prime example could be autonomous vehicles, including self-driving cars and advanced driving assistance systems. They, essentially, operate with rolling cameras and sensors that must make split-second decisions, and they can't wait for the data to make the round trip to the data centre. Lives are at stake if a car doesn't react in a millisecond."

Augmented and virtual reality applications present similar requirements. "You can also think about augmented and virtual reality systems, for instance AR glasses. So, if you move your hand, and the system sort of overlays a graphic, any perceptible lag ruins the experience, or can cause motion sickness in VR, which is termed vergence accommodation conflict (AC) error," he says.

Healthcare applications show how edge computing enables real-time diagnostic capabilities that weren't previously possible. "In healthcare, there may be AI-powered imaging devices in clinics, for example, portable ultrasounds or an MRI machine. These devices use the AI to analyse the scans in real-time, and require certain edge processing, therefore, to help the doctors."

Industrial vision applications showcase the technology's value in manufacturing where immediate feedback is crucial.

Garcea identifies additional mission-critica applications across diverse sectors: "There are other applications. For example, military defence is finding this technology quit popular, and drones or tactical decisions in remote environments. Agritech is also a good example, again in remote settings, and users want to check whether some of the areas can be dedicated to agriculture or not. Sorting of fruits is another typical video analytics application."

Rethinking chip architecture

Developing integrated circuits specificall for edge computing applications requires a fundamental rethinking of chip architecture. The traditional approach of using general-purpose processors proves inadequate for the unique demands of edge-based computer vision applications.

"There are hardware features you need to implement, which are really intended to be specific for AI. So, first, you need to work o the architecture of your chip. The objective is, basically, flexibilit . You need to support not a single neural network, but a number of those neural networks, and that's to allow for flexibility and adapt to performance scaling, Garcea explains.

Multi-core architectures provide the flexibility needed to handle varyin workloads. "We have a multi-core architecture, so you can have multiple neural networks running parallel, or you can improve performance by mapping the same neural network on two or four different cores. In that case, you privilege performance."

Memory architecture becomes particularly critical in AI-focused chips. "You need to think that these chips are memory-dominated; more than 60% (in our case) of memory is SRAM memory. SRAM is a highly utilised piece of silicon, where the yield is lower than other parts of the chip. In order to recover from the yield loss, you implement redundancy."

Thermal management must be built into the chip architecture from the ground up. "The chip must have a PVT sensor to measure power, voltage and temperature. Based on that, you implement a thermal throttling mechanism, meaning that if you reach a certain temperature, the processor automatically reduces the clock speed and the performance… to prevent chip damage."

Longevity is increasingly important for industrial and medical applications. Kamran notes: "From our perspective, looking from the consumer side, we're working with a lot of these tech providers, and the customers are very interested in the longevity support. It's one thing to make the chip itself really reliable – that's got to be a very integral part of it – but you need specialised, accelerated energy efficiency as well, which mean moving towards more sustainable AI chips."

Hyperspectral imaging breakthroughs

Hyperspectral imaging represents an excellent case study for understanding how edge computing transforms data-intensive applications. The volume of data generated by hyperspectral cameras makes cloud processing impractical in many scenarios.

Kamran says: "Hyperspectral imaging is a perfect example of where edge computing makes a dramatic difference. Hyperspectral cameras capture hundreds of wavelengths per pixel. So they're creating rich images, and the data volumes are huge; often one gigabit per second for a single camera."

The traditional approach of storing or streaming this data to remote servers doesn't work in practical deployments. "Historically, dealing with that meant storing

"Hyperspectral cameras capture hundreds of wavelengths per pixel… often one gigabit per second for a single camera. Edge computing allows you to process and compress that data on the y'

Faisal Kamran, Sony

WrightStudio/shutterstock

piles of data, or trying to stream it to a powerful remote server which isn't practical in many scenarios. Edge computing allows you to process and compress that data on the fl , right where it's collected."

Real-time agricultural applications demonstrate the transformative potential of edge-processed hyperspectral imaging. "You can put an edge computing module on a drone or a tractor that's carrying a hyperspectral imaging camera over fields, and, instead of just recording the data to analyse later, the edge processors can identify the crop stresses in real time."

The immediate actionability of results represents a paradigm shift from traditional data collection approaches. "The farmers get an immediate alert, stating this section of the crop shows disease and they can act quickly. Without edge processing, you would have to send that raw spectral data to a lab or a cloud, and maybe wait hours, or even days, for results."

The future of edge computing for vision

The market dynamics surrounding edge computing paint a picture of explosive growth and technological advancement. Market predictions suggest significan investment and adoption in the coming years, with fundamental shifts in how enterprise data processing is approached.

"In 2024, more than $6bn was invested in edge computing. Now, in 2025, the market is estimated at $14.5bn and we expect growth of around 20% year-on-year until 2032," Garcea says. "In terms of usage and adoption of edge devices, in 2026 edge computing is expected to make up 75% of the enterprise data processing with latency that is less than five milliseconds.

Technological advances promise to push the boundaries of what's possible at the edge. "In terms of technology, we are moving to more efficient ASIC accelerators for AI. There are a few players in this market. We are moving into vision transformers that are becoming quite popular with respect to traditional CNN (convolutional neural networks). I would say it's very promising, especially if you talk about efficiency wit neuromorphic computing."

The integration of photonics with AI processing could enable unprecedented performance levels. "The other topic is related to integrating AI devices, together with photonics for cheap integrated sensing. This is also a big topic; this is showing already that you can potentially compute less than one billion of pixels with the response of nanoseconds. We have been talking now about millisecond responses. Going into the nanosecond space would open up a new field of real-time application.

Kamran says: "I anticipate real-time video analytics will be almost everywhere. Whether it's analysing customer behaviour in retail stores, or traffic monitoring in cities real-time vision of edge devices will proliferate."

Best practice for edge deployment

Successfully deploying edge computing solutions requires a strategic approach that begins with clearly defined proble statements rather than technology-firs thinking. The experts emphasise the importance of understanding specifi requirements before selecting technologies.

"No matter what application you are trying to develop, as long as you have a really good, clear, valuable use case, and you define your problem well, I think that s where you can define the type of technolog that might be sufficient to produce that. You can always overkill a product. But do you actually need to?" Kamran asks.

Cost must remain central to technology selection. "Everything has to make budget sense. If you're going to make a million-dollar product, but nobody is willing to buy it because it's just too expensive, it's a waste of resources. Just introduce sufficien technology to solve the use case you have, you don't need to spend more than that."

Incremental development approaches help manage complexity and reduce risk. Garcea advises: "Build incrementally, and use the right software stack; something that is stable. Engaging with a community is also very important. Think about communities today such as Arduino or Raspberry PI. Those are environments that allow you to deploy and use AI edge solutions together with this kind of platform."

The fundamental principles for successful edge computing implementation are straightforward, but critical, concludes Kamran: "Start with a focused use case. Use your available tech. Don't over-complicate it. Keep your security and resilience in m ind when you're producing the product. List the hardware which is sufficien to just deliver that, and learn by doing." i

This is an edited transcript. To view the full discussion, please go to: imveurope.com/webcasts

Scaling with soul: How Components Express by 2Connect is building for future of custom connectivity

When the opportunities to scale respected US cable company CEI were slowing, it entered into a bold partnership to help create a mid-size powerhouse. Company head Clayton Webber (right) explains...

In an industry where businesses often sit at opposite ends of the spectrum – either specialised suppliers or massive, standardised multinationals – 2Connect and Components Express (CEI) are in the process of creating something different.

Together, they are forging a mid-sized powerhouse that blends agility and engineering precision with global reach and operational resilience. Their story isn't just one of growth, but of intentional transformation rooted in shared values, trust and a commitment to long-term innovation.

For Clayton Webber, the journey began five years ago when he stepped into th role of CEI Chief Operating Officer and eventually, President/General Manager.

The US manufacturer and total solution provider for demanding connectivity, enclosure and mounting technology in the vision and industrial automation ecosystem was, of course, known for its technical capabilities, long-serving team, and entrepreneurial culture. But, while the company had built a reputation for excellence, it faced limits to its scalability.

"This was a company built on integrity, with a team that had clearly been invested in for the long-haul," says Webber. "The average employee tenure was – and is – more than 15 years. During the pandemic, it didn't lay anyone off. That told me a lot about what mattered here."

Founded in 1992 by John and Ray Berst, CEI had matured into a respected US manufacturer of cables, enclosures and mounting technology. Yet, it faced a crossroads: demand was increasing – particularly in Europe, which already accounted for 25% of its business – and its US-centric operations were struggling to keep pace.

"We had a strong foundation and a high-performance team," says Webber. "But we were capacity-constrained and geographically limited. We couldn't serve Europe the way we needed to, especially with long lead times, time-zone challenges, and the environmental impact of shipping heavy materials, such as copper, overseas."

A strategic fit, not just a financial o

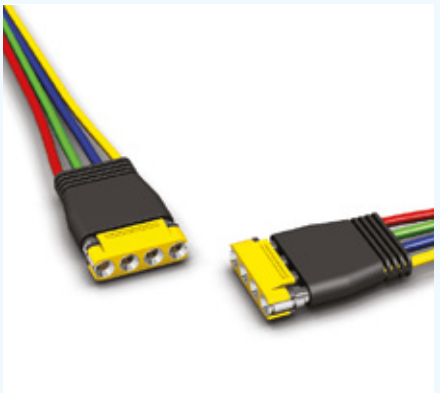
CEI explored various options to address these scaling challenges – but Webber and the leadership team were determined to secure more than just a capital injection.

"There were investors who were interested," Webber recalls. "But it was clear to us early on: we weren't looking for a transaction. We were looking for a transformation – one that respected who we were, and a company which could help us become who we wanted to be."

That transformation began taking shape when conversations started with 2Connect, a Netherlands-based company led by CEO Mark van den Heuvel since 2022. Similar to CEI, 2Connect had grown from entrepreneurial roots into a strategic global player, offering high-mix, low- to mid-volume custom cable assemblies for industrial, medical, semiconductor, heavy duty vehicles, defence and robotic applications.

What followed was less a negotiation and more a courtship. The leadership teams met frequently, toured each other's facilities, and held candid conversations about culture, values and vision.

"It was clear from the beginning that this wasn't just about synergies – it was about shared DNA," says Webber. Van den Heuvel agrees: "When we walked CEI's floor an met the people, we just knew… there was



2CONNECT

CoaXPress 6 cable for high-speed vision applications

2CONNECT

The company operates from locations around the globe, serving clients more effec ively

engineering talent, craftsmanship and humility. It felt like family."

Integration with integrity

The acquisition of CEI by 2Connect was finalised in 2023, but CEI s cultural transformation had already begun. Despite the inevitable apprehension among long-serving staff, Webber made communication the cornerstone of the transition. "We were incredibly transparent," he says. "We told people what was happening, why it was happening, and what it meant for them. Most importantly, we showed them that nothing about our core values was going to change."

That clarity paid off: not a single employee left as a result of the acquisition – a rare outcome in mergers and acquisitions.

"It is a huge point of pride for us," Webber says. "And a testament to how well the teams meshed."

The post-acquisition phase wasn't about imposing systems, but integrating capabilities. CEI began manufacturing 2Connect's products in the US, while production for CEI's European customers ramped up at 2Connect's facilities in Romania and the Netherlands. With production now closer to customers, lead times shrank, shipping costs dropped and service quality improved.

"Our model is: 'In the region, for the region'," says Webber. "We don't believe in centralising everything in one place. If a customer wants project management locally, that's how we'll do it – regardless of where the product is ultimately made."

At 2Connect, van den Heuvel has formalised values that came naturally across the group: Customer-Driven, Connect with Care, Grow and Learn, and Take Ownership. Notably, all of the four companies acquired by 2Connect were family-owned, which has helped strengthen this shared DNA of integrity and long-term thinking.

"For me, for example, 'Connect with Care' means creating a safe environment where people are challenged to grow, but supported if they stumble," van den Heuvel says. "That's how you build a team that can adapt and thrive."

> **"This isn't about getting bigger. It's about getting better. Better systems, better teams, better service"**

One of the drivers of CEI's success has always been its engineering culture. The company is a high-mix, low-volume specialist, with an emphasis on custom solutions and early-stage design support. "Increasingly, we're not a catalogue company," Webber explains. "We work closely with our customers' engineers to create purpose-built assemblies that meet specific environmenta and performance standards."

CEI continues to invest in its R&D division, which is actively contributing to industry standards such as USB Vision and CoaXPress (CXP). Its product roadmap includes longer-distance USB-C and high-flex coax cables designed for vision us and even higher speed future protocols – which offer far beyond what off-the-shelf consumer options can deliver. "We serve customers in medical, defence, aerospace, semiconductors, robotics and telecom," Webber says. "These aren't industries where you can cut corners. Every cable is tested for signal integrity, shielding and durability under real-world conditions. We assume all applications are mission-critical."

A model for purpose-driven scale

Together, 2Connect and CEI now employ more than 600 people worldwide, with about 50 based at CEI's headquarters and manufacturing facility in Woodridge, Illinois. While the company's product mix is still about 70% standards-compliant assemblies and 30% custom designs, the custom side is growing fast – driven by demand for more integrated and application-specific solutions

To support continued growth, the company has expanded manufacturing capacity, including the ability to set up dedicated assembly lines for strategic, high-volume customers. But Webber is quick to point out that CEI's success isn't just about throughput. It's about thinking ahead.

"We often tell customers to bring us in early," he says. "Interconnection solutions such as cables and connectors are usually one of the last things considered in system design. But if you think about connectivity from the start, you can save money, avoid headaches, and build something that performs better in the field. Cables are ofte an afterthought. But if we're brought in early, we can influence performance, reliability an cost in ways that surprise people."

Van den Heuvel agrees. "We're not just here to sell parts. We're here to co-develop roadmaps. We want to understand your five year vision and help make it possible."

One brand, one team

As the integration matures, 2Connect is moving toward a unified brand across al of its entities, with one website, one visual identity, and one customer experience – regardless of geography. This is supported by a dual operating model. Local entities remain focused on efficient production, while globa business lines, such as vision systems or medical applications, manage strategy and customer engagement across regions. It's a structure that combines the best of both worlds: local focus and global alignment.

2CONNECT

Camera mount and enclosure

Van den Heuvel emphasises that group growth isn't the only metric. "We're not expanding just for the sake of it," he says. "We want sustainable partnerships, where we co-develop roadmaps and help our customers think three or five years ahead

"We don't go into a region just because the sun is shining," he says. "We go where we see real, sustainable opportunities – usually alongside a customer who's growing with us."

That sentiment is echoed by Webber, who says: "This isn't about getting bigger. It's about getting better. Better systems, better teams, better service."

Nearly two years into the partnership, the results speak for themselves: faster lead times, deeper technical collaboration, greater geographic reach, and a team that's as engaged as ever. For Webber, the journey has been both personal and professional.

"I've always believed that the best companies don't just build great products – they build great people," he says. "What we've done here is prove that you can scale without losing your soul."

Two years into their partnership, 2Connect and CEI are not just scaling – you could say they're scaling with soul. The result is an international connectivity powerhouse that's as focused on relationships as it is on results. "We're small enough to care, and strong enough to deliver," van den Heuvel says. Webber echoes that sentiment: "We're not just growing bigger – we're growing better." i

How non-visible light is revolutionising industrial imaging

From quality control of silicon wafers to detecting bruised fruit or preventing maritime collisions, non-visible light wavelengths offer transformative imaging opportunities. Our expert panel discussed some of these applications and the challenges in implementing them

Non-visible light wavelengths are transforming how industries monitor, detect and analyse their environments. What was once the domain of specialised research laboratories is rapidly becoming an essential tool across sectors ranging from precision agriculture to pharmaceutical inspection.

The fundamental shift towards infrared, ultraviolet and hyperspectral imaging represents more than just technological advancement – it's opening entirely new windows of perception that reveal details invisible to the human eye and conventional cameras.

Recent insights from industry experts at North American Coating Laboratories (NACL), SEA.AI and Sony illuminate the profound impact these technologies are having across diverse applications.

Advantages over standard visible-light imaging

The core advantage of non-visible imaging lies in its ability to reveal phenomena that cannot be detected through conventional means. "Imaging with non-visible wavelengths, such as infrared or ultraviolet light, offers fundamental advantages over standard visible-light imaging," explains Faisal Kamran, Principal Technology Analyst at Sony. "Non-visible light can reveal details and phenomena that the human eye and visible cameras simply cannot detect."

This capability extends far beyond basic night vision applications. Infrared imaging can capture thermal emissions, enabling vision in total darkness while revealing heat patterns or defects such as overheating components that remain invisible under visible light. Perhaps more remarkably, certain non-visible wavelengths can penetrate materials that appear opaque to the naked eye.

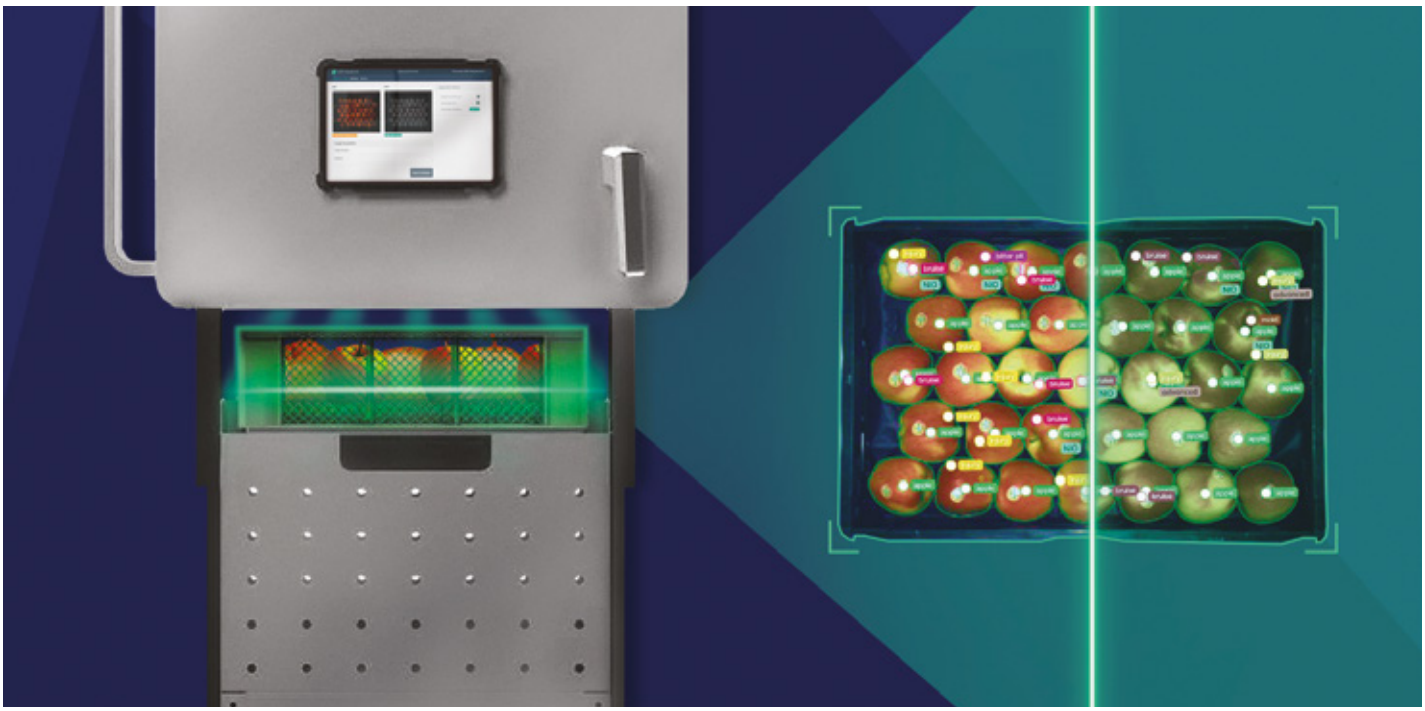
> "Hyperspectral imaging eliminates long-standing R&D bottlenecks... translating lab-level analysis into practical, real-time applications across industries"
>
> **Faisal Kamran, Sony**

"Short-wave infrared (SWIR) and other bands can penetrate materials or environmental obscurants where visible light fails – fog, smoke, water vapour and even certain solids such as silicon can become transparent at these wavelengths," Kamran notes.
This transparency effect enables applications that would be impossible with conventional imaging, such as seeing through plastic packaging or examining silicon wafers, while also allowing for precise moisture content analysis.

Brian Wilson, President and CEO of NACL, emphasises the breadth of applications this technology enables. He says: "There are a lot of different things that infrared imaging can be used for that vary from the visible spectrum imaging things. This includes thermal imaging for heat detection, for a variety of different uses; lowlight, and no light operations for near infrared."

The technology's impact becomes particularly evident when considering real-world challenges. In maritime environments, where safety depends on 24-hour vigilance, traditional visible light cameras become useless after dark.

Philipp Stampfl, Product Manager at SEA.AI, explains his company's motivation: "Our mission is to increase safety at sea. And first of all, we want to solve a problem. And the problem is that there are still lots of collisions, and there



Images: ams OSRAM, Friedrich Schiller University Jena and Fraunhofer IOF, Sea.ai

Above: Shortlisted for the Photonics Frontiers Award this year, ams OSRAM, Friedrich Schiller University Jena and Fraunhofer IOF have developed a compact multispectral sensor that detects fruit ripeness, helping reduce food waste across the supply chain.

Left: The Offshore camera line from Sea.ai combines outputs from visible light and thermal cameras to identify obstacles at sea

are still lots of risks when you are at sea. Therefore, we are looking for sensors which work 24/7."

A spectrum of imaging solutions

Understanding the distinct advantages of different non-visible wavelengths is crucial for selecting the right technology for specific applications. The electromagnetic spectrum beyond visible light offers several distinct regions, each with unique properties and capabilities.

Near-infrared (NIR), typically defined as wavelengths from 780-to-1,400 nanometres, represents the most accessible entry point into non-visible imaging. "Near-infrared (~0.78-1.4 µm) technology uses conventional optics and CMOS sensors, making it highly cost-effective for industrial applications," Kamran explains. "NIR light penetrates materials such as inks and plastics while working better in adverse conditions such as haze or dust."

The practical advantages of NIR extend to numerous industrial applications, from security cameras with invisible illumination to biometric systems and factory inspection processes that remain effective regardless of object colour. The technology produces high-contrast monochrome images that can reveal hidden features such as packaging fill levels or fruit bruises that visible light cannot detect.

Moving deeper into the infrared spectrum, short-wave infrared (SWIR) occupies the range from approximately 1,400-3,000nm. While requiring specialised InGaAs sensors, SWIR offers superior material discrimination capabilities that can justify the additional complexity and cost.

"Water strongly absorbs SWIR light at 1,450nm and 1,900nm wavelengths, enabling precise moisture detection in food processing and agriculture," Kamran details. "Silicon becomes transparent in SWIR, allowing semiconductor wafer inspection beneath surfaces, while different black plastics show distinct SWIR signatures for automated recycling sorting."

Long-wave infrared, encompassing wavelengths above 3,000nm, captures heat radiation rather than reflected light, enabling zero-light operation for applications including predictive maintenance, security surveillance, and driver assistance systems.

Wilson notes the practical distinction: "Long-wave infrared is usually used for thermal detections, along with some of the night vision stuff. I think the short wave infrared, or the near wave infrared is often used more for material penetration and surface characterisation."

Non-visible imaging applications across industries

The transformative potential of non-visible imaging becomes evident through specific application examples that demonstrate capabilities previously thought impossible.

In archaeological research, the technology is literally uncovering lost civilisations.

Wilson describes a particularly fascinating application: “They’ve recently been finding some pretty ancient civilisations deep in the Amazon jungle that have been forgotten for hundreds of years, due to natural catastrophes and suchlike. If you just send drones or normal visible imaging over these, all you see is a rainforest. But we’re using proper imaging techniques that can look either through that first level of forestr , or even in some cases below the surface of the ground and into the dirt, and some of the debris that’s on the ground.”

In agricultural applications, the technology enables quality control measures that surpass human capabilities.

“In the agricultural areas, they can detect bruised fruit, that may not be visible to the surface, before it gets into the grocery store,” Wilson explains. “They can kick out a fruit that is bruised on the subsurface, but they know that within a day or two that bruise is going to come to the surface and become an unusable food item.”

Emergency services represent another critical application area where non-visible imaging provides life-saving capabilities.

Wilson describes innovative firefightin applications: “Some of the new novel firefighter helmets have both visible an infrared technologies built into them. So, as the firefighters enter a trauma situation once they’re in and they’re immersed in debris, smoke, or dust in the air, they can no longer see without infrared imaging. Infrared can even be used to look through walls to see if there are still people within a troubled situation, that they can identify and try to rescue.”

The maritime industry demonstrates how non-visible imaging addresses fundamental safety challenges. Stampfl explains how the technology serves both commercial and rescue operations: “The thermal sensor, on the other hand, is very powerful, and sees through the night, but also detects people, possibly overboard in the water. So that’s why we work with search and rescue organisations to support them with a detection system in the mission of saving lives.”

Hyperspectral imaging revolution

At the cutting edge of non-visible imaging lies hyperspectral technology, which captures dozens to hundreds of wavelength bands across multiple spectra, providing detailed spectral fingerprints for each pixel in an image. This capability enables precise material and chemical discrimination beyond what single-band methods can achieve.

Kamran explains the transformative impact: “Hyperspectral imaging eliminates long-standing R&D bottlenecks, combining high spatial and spectral detail, streamlining multiband experiments, and translating lab-level analysis into practical, real-time applications across industries.”

The technology addresses a fundamental trade-off that has long constrained research and development efforts. “There used to be a trade-off to be navigated between either high spatial resolution from the camera, or high spectral resolution from the spectrometer,” Kamran notes. “But modern hyperspectral cameras, such as Sony’s latest with record-setting combined resolutions, deliver a full, finely sampled spectrum for every pixel.”

This advancement enables researchers and industrial users to not only identify unknown substances, but also pinpoint their exact location within an image. The applications span from precision agriculture and mining to environmental monitoring and medical diagnostics, with the technology offering simultaneous spatial and spectral analysis with laboratory-grade precision.

Technical challenges and hard-won lessons

The transition from visible to non-visible imaging involves significant technica challenges that extend beyond simply selecting different sensors and light sources. Wilson’s experience with infrared coating production illustrates the complexity involved in adapting existing processes to new wavelength requirements.

“Some of the differences in working with infrared optics and infrared materials and substrates, versus visible substrates are that a lot of the optics made out of infrared materials are far more delicate and brittle than some of the glass materials that are out there,” Wilson explains.

This fundamental material difference requires entirely new handling procedures and specialised tooling.

Temperature control emerges as a critical factor often underestimated in initial planning stages. “A lot of these coatings are put on at very specific temperatures, and the temperatures are often much more critical in the infrared materials than they are in some of the glass materials,” Wilson notes. “With glass, you just turn that thing all the way up to high, and put the coating on, and you get a good result. But a lot of these infrared materials require very close control of temperature during the deposition process.”

The learning curve can be steep and costly. Wilson recounts a particular challenge: “We used some stainless steel tooling once for a job, and then we did the coating. Following this the part was perfect in the middle, but around the edges the coating was failing dramatically. We then realised over time that the heat

“In the agricultural areas, they can detect bruised fruit, that may not be visible to the surface of the fruit, before it gets into the grocery store”

Brian Wilson, NACL

> “We are looking for sensors which work 24/7... the thermal sensor is very powerful, and sees through the night, but also detects people possibly overboard in the water”
>
> **Philipp Stampfl, SEA.A**

transfer from the stainless steel, into the edges of the part where it’s being held during the coating process was enough of a difference to cause that thermal differentiation; a difference in coefficient of thermal expansion to cause the coating to fail at the edges.”

Material preservation presents another significant challenge, particularly with advanced infrared materials. “When you talk about infrared materials, you’re talking about silicon and germanium; you’re talking about zinc selenide and zinc sulfide. And then there’s a new class of materials called chalcogenides,” Wilson explains. “Those infrared materials out of the chalcogenides are very challenging, and a lot of them will oxidise, even just during transportation.”

How to integrate non-visible imaging systems

Successful implementation of non-visible imaging requires a systematic approach that begins with clearly defined objectives

Wilson emphasises the importance of early planning: “First you have to define the imaging objective. What are you trying to image, whether you’re trying to do a surface penetration, surface analysis, temperature mapping; what is the goal of your overall application?”

Kamran, too, recommends a structured methodology: “Begin with the application. Clearly define what feature needs to be seen, whether it’s heat patterns, hidden markings or material composition; and pick the spectral region – UV, NIR, SWIR, thermal IR – that is known to reveal it.”

Environmental considerations are crucial in system design. “Assess ambient light, safety and whether passive (thermal) or active illumination is required,” Kamran advises. “For example, indoor machine-vision often uses invisible NIR LEDs, whereas outdoor sunlight may force a narrower IR band or optical filtering.

The importance of matching sources with compatible sensors cannot be overstated. “Ensure the detector’s sensitivity overlaps the emitter’s output,” Kamran explains. “For instance, you may have silicon sensors for NIR, InGaAs for deeper SWIR, or UV-sensitive cameras for fluorescence.

Sensor fusion and future trends in non-visible imaging

The rapid advancement in sensor technology, lighting solutions and edge AI is pushing non-visible imaging from niche research applications towards everyday industrial tools.

Kamran predicts “rapid advances in sensors, lighting and edge AI pushing non-visible imaging from niche research to everyday tools, giving machines sharper, more versatile ‘eyes’ across the UV-to-thermal spectrum.”

Sensor fusion represents a particularly promising development direction.

“Systems blending visible, NIR, SWIR, thermal and lidar data – sometimes on a single chip, for example SenSWIR – to ensure reliability under any lighting or weather, a critical feature for autonomous platforms,” Kamran explains.

Stampfl sees continued evolution in maritime applications. He says: “Machine vision will continue to be a key element. There is no way around machine vision... sensor fusion is something to watch out for. Machine vision only involves one sensor. There is also radar light, and this is a trend I see in our domain.”

The democratisation of the technology appears inevitable as costs decrease and capabilities increase.

“Falling prices, expanding training, and emerging safety and data standards could make beyond-visible imaging plug-and-play across automation, smart farming, environmental monitoring and consumer electronics possible,” Kamran predicts. i

This is an edited transcript. To view the full discussion, please go to: imveurope.com/webcasts

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Unlock powerful insights with IR, NIR, SWIR & hyperspectral

See what standard imaging can’t. Join this expert panel to learn how advanced spectral imaging technologies are transforming quality control, material detection and process monitoring across key industries. Discover how to choose the right approach, avoid integration pitfalls and apply these tools to solve real-world machine vision challenges.

Integrating machine vision into Industry 4.0: Smarter systems, better decisions

Discover how connecting machine vision with industrial IoT and automation platforms is transforming manufacturing. In this expert panel, learn how to unlock real-time insights, boost efficiency and enable predictive maintenance in smart factories. Explore integration strategies, data management best practices and real-world success stories that bring Industry 4.0 to life.

Building a business case for machine vision: From cost to competitive edge

Machine vision delivers real return on investment – but how do you prove it? In this expert panel, learn how to justify investment by quantifying cost savings, efficiency gains and long-term value. Explore real-world strategies for overcoming adoption hurdles, aligning stakeholders and making a strong financial case for machine vision in modern manufacturing.

Synthetic data, real results: Rewiring industrial inspection to work with AI

Sightwise wants to make AI inspection look simple, by reducing time, cost and complexity with simulation-based vision technology. Co-founder Nils Graf-Gutsche explains

Imaging & Machine Vision Europe: Tell me about Sightwise and the inspiration behind the company and technology?
Nils Graf-Gutsche: Sightwise is a science-based spin-off from Leibniz University Hannover, Germany. Three of the four co-founders completed their PhDs at the university's Institute of Measurement and Automatic Control. The idea for Sightwise emerged at the intersection of their three doctoral research projects and was validated through early successful collaborations with industry partners. When a funding opportunity became available, the team decided to formally launch the venture. To strengthen the founding team, a fourth co-founder joined, bringing more than six years of experience in quality management at a leading automotive OEM.

As a company that develops AI-powered inspection solutions for the manufacturing industry, with a focus on sectors such as aviation and automotive, our approach leverages synthetic data to address the limitations of traditional AI, enabling companies to create more robust inspection software and accelerate their AI development cycles. Our flagship product, the SightHub platform, supports the entire AI development workflow in a step-by-step, no-code environment.

IMVE: How would you describe your software platform's value proposition to industrial manufacturers?
NGG: At Sightwise, we specialise in addressing edge cases in manufacturing inspection. With nearly all of our clients, we work to automate inspection processes that were previously performed manually. This is particularly challenging in environments with high product variability, complex geometries, dynamic conditions, or rare defect types – scenarios where traditional machine learning approaches often fall short.

In many of these cases, there simply isn't enough high-quality representative data to train a model capable of delivering reliable inspection performance. By leveraging synthetic data, we automate the data generation process and create customised datasets with the precise volume and variability needed. This enables us to significantly improve model robustnes and optimise inspection outcomes.

IMVE: Tell me about the software architecture. What are the technologies or frameworks it's built on, and why have you chosen to take those routes?
NGG: Our technology pipeline begins with a 3D geometry, rather than relying on large volumes of real-world data that would need to be manually collected and annotated. We bring this geometry into a physically-based simulation environment, where we model all factors relevant to the inspection use case – such as lighting, background, materials, defect types and more. From this simulation, we automatically generate photo-realistic images along with perfectly aligned annotation data. In certain scenarios, we may enhance the dataset further using generative AI techniques.

We then train AI models for specific computer vision tasks such as object detection, segmentation and pose estimation. The resulting models can be deployed via an API endpoint on our SightHub platform, or downloaded for on-premise use on edge devices, for example. To meet strict data privacy and security requirements, the SightHub platform can also be installed locally on customer-owned infrastructure.

IMVE: How hardware-agnostic is the system? Is it simple to integrate with existing vision systems?
NGG: Integration with our system is straightforward, as both the inputs – such as 3D geometry files (e.g. .ST files) or images – and the outputs, are typically provided via a REST API, relying on widely accepted standard formats. If a customer requires an extension of the pipeline, we can easily accommodate that by leveraging standard industrial communication interfaces such as GenICam, OPC UA and others, ensuring seamless compatibility with existing systems and workflows

IMVE: Where does the processing happen? On the edge or in the cloud? Or both?
NGG: Customers have the flexibili y to choose how they deploy the SightHub platform – either hosted in the Sightwise cloud or installed on their own infrastructure.

IMVE: Is this a big requirement for your customers?
NGG: For some clients, especially those with strict data governance or security requirements, an on-premise installation is mandatory and fully supported.

IMVE: Are you able to share any historic or ongoing use cases or collaborations where the software has been employed?
NGG: Most of our customers come from aviation and automotive. Many of our projects focus on the surface inspection of metal components. Recent use cases include inspecting aircraft parts for surface defects, analysing forged metal parts in the automotive sector and mapping surface defects directly onto 3D geometries for a client in the casting industry.

IMVE: What are some of the hardest challenges manufacturers face with the use of machine vision?
NGG: The lack of high-quality training data remains one of the biggest challenges in applying AI to inspection processes

Sightwise

From left: Dr Philipp Middendorf, CEO; Dr Nils Melchert, Head of Technology, Dr Kolja Hedrich, Head of Product and Nils Graf-Gutsche, COO, Sightwise

> “Synthetic data is not merely a ‘nice-to-have’ feature – it is often the key enabler for automating inspection tasks”

in manufacturing. This is especially true in high-mix, low-volume production environments where traditional methods – that rely on manual data collection and annotation – are often impractical and time-consuming.

IMVE: How does your system help overcome these issues?

NGG: Our synthetic data generation approach, based on 3D object models, enables companies to streamline and automate the AI development process. It allows for the creation of robust inspection solutions for new components even before the start of production, significantly reducing time-to-deployment and improving scalability.

IMVE: Which sectors have been fastest to adopt machine vision so far?

NGG: While the PCB (printed circuit board) industry appears to be quite advanced in automating inspection processes, it is not our primary focus.

We believe the greatest potential for synthetic data lies in industries that have struggled to adopt AI-based inspection altogether. In these cases, synthetic data is not merely a “nice-to-have” feature – it is often the key enabler for automating inspection tasks that previously lacked any viable solution.

Rather than targeting specific verticals, we focus on companies operating in high-mix, low-volume production environments, particularly those utilising processes such as forging, casting or coating. These are typically industries where surface quality is critical – either for functional safety or for aesthetic standards.

IMVE: What do you think are the biggest limitations of machine vision systems, and how is Sightwise working to overcome them?

NGG: To effectively address a customer challenge in quality assurance, machine vision is just one part of the solution. Clearly defining the scope – where it begins and ends – is essential to shaping a sustainable business model. Ultimately, what matters most is solving the customer’s problem end-to-end.

To support this, we are actively building a partner network that enables us to offer comprehensive solutions while focusing on our core competencies.

IMVE: How do you think this is likely to change in the future?

NGG: One common need is the alignment between hardware and software. We’re seeing a positive trend: more companies are developing in-house expertise in hardware integration, which increasingly supports the viability of a software-only business model on our side. i

Teledyne
Z-Trak Express 3D laser profile

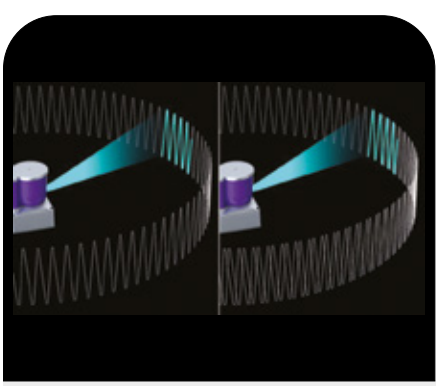
The Z-Trak Express 1K5, from Teledyne DALSA, is a 3D laser profiler fo in-line measurement and inspection. Reportedly capturing up to 5,000 profiles per second w th a 1,700mm horizontal fiel -of-view, it enables the single-sensor inspection of wide objects – such as road surfaces, automotive parts and lumber.

The system supports multi-sensor set-ups for 360° inspection and thickness measurement, without losing Z-resolution, features real-time on-board processing, HDR imaging and eye-safe laser options, without the requirement for in-field calib ation.

Z-Trak Express comes with additional software included such as Z-Trak 3D Apps Studio, Z-Expert and Sherlock 8, for integration with industrial systems.

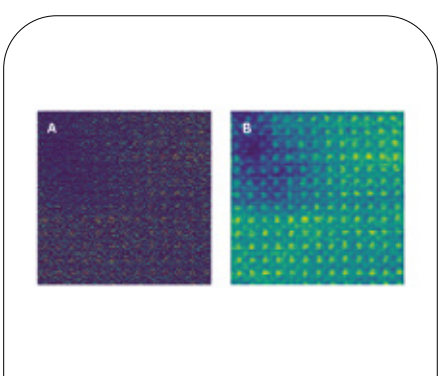
SVS Vistek
FXO 25GigE Series Camera

SVS Vistek's FXO 25GigE camera series features remote direct memory access (RDMA) for direct data transfer to host memory, reducing CPU load and latency. Paired with a 25GigE interface and SFP28 optical transceivers, they support cable lengths up to 10km. A wide number of configurations available, ranging fro 96fps at 24.6MP up to 671fps at 1.8MP. All support GenICam 3.0 and GigE Vision, for system compatibility. Additional features include LUT, ROI, binning, a four-channel strobe controller, SafeTrigger I/O and a compact 50x50x100mm housing, with optimised thermal management.



Orbbec
Pulsar ME450 3D lidar MEMS mirror and motor

Orbbec's Pulsar ME450 is a direct time-of-flight 3D lidar sensor that combines a MEMS mirror with motorised azimuth control to enable multiple scanning modes and an adjustable vertical field of vie . Orbbec says the system supports repetitive (both dense and non-dense) and non-repetitive scanning, and seamlessly switches between them, which allows the single sensor to handle both navigation and fine-grained 3D reconstruction tasks. It is designed for applications such as logistics robots and smart forklifts.



SenseAI
Live 4D STEM imaging software

New, low-dose 4D STEM imaging software from SenseAI enables a 10% reduction in the typical data load. Integrating with existing electron microscopes, the software reduces beam exposure, while allowing real-time dynamic imaging and analysis. According to SenseAI, the software addresses key limitations in 4D STEM such as drift, long-acquisition times and large data volumes. Users are able to view and adjust datasets live, to preserve sensitive samples and avoid reacquisition. It also supports live virtual detectors, live DPC, centre of mass imaging and post-processing techniques.

Phytec embedded vision development kit

Phytec and Vision Components have collaborated to release two embedded vision kits based on NXP's i.MX 8M Plus and i.MX 8M Mini processor boards. The kits support more than 50 VC MIPI cameras ranging from 0.5MP to 20MP, including global and rolling shutter types. Both kits are plug-and-play and include V4L2 drivers for integration with software such as OpenCV, GStreamer and Halcon. Phytec says the i.MX Plus supports HDMI output, while the i.MX 8M Mini features 10" touch-screen display.

Basler
IP67 Camera

Basler has designed a fully integrated IP67-rated vision system, for harsh environments where exposure to dust, dirt and/or water is common. The system's ace 2 camera has a compact, yet industrial-grade housing, an M12 GigE connector and operates at up to 51fps. Matching lenses, protective housings and ring and bar lighting are all also available in a range of complementary colours and sizes. With all components tested for compatibility, Basler confirms integration time is reduced and configuration is simple.

DIVA Labs surgical displays

Three key imaging products were recently announced by DIVA Labs, including 55" and 65" optical bonding LCDs for surgical use. The large-format displays feature AGAR (anti-glare and anti-reflective) glass, an are engineered to reduce ambient light interference, improving image quality in surgical environments. An off-the-shelf QDII display platform is also now available from the company, which is targeting entry-level medical and industrial applications, as well as OLED displays to address burn-in and lifespan issues, and can be integrated into ultrasound systems.

e-con Systems
RouteCAM_CU86

RouteCAM_CU86 is a 4K HDR GigE camera, designed by e-con Systems for smart vision applications in challenging lighting conditions. Based on the Sony STARVIS 2 IMX678 sensor, the RouteCAM offe s up to 110dB HDR and 0.1lux sensitivity – making it suitable for low-light and high-contrast spaces such as parking garages, intersections and surgical lighting.

The IP67 camera supports ONVIF compliance and is compatible with standard NVRs and VMS platforms. Designed for industrial use, the camera's features include H.264/H.265 compression, PTP synchronisation, digital pan-tilt-zoom and secure cloud-based device management.

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