Visionaries 2025

The most innovative integrators in imaging and machine vision

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LASER WORLD OF PHOTONICS

Published by

IMAGING & MACHINE VISION EUROPE

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Imaging and Machine Vision Europe is published by Europa Science Ltd, 4 Signet Court, Cambridge, CB5 8LA, UK
Tel: +44 (0)1223 221030 Fax: +44 (0)1223 21338
Web: www.imveurope.com ISSN: 1745-5758

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Daniel-Eduardt Sandu, founder and Managing Director, AiDEXA

Combining machine vision with Raman spectroscopy to solve niche material inspection challenges

Daniel-Eduardt Sandu, founder of AiDEXA, explains how the company blends engineering pragmatism with precision spectroscopy to overcome tough inspection problems

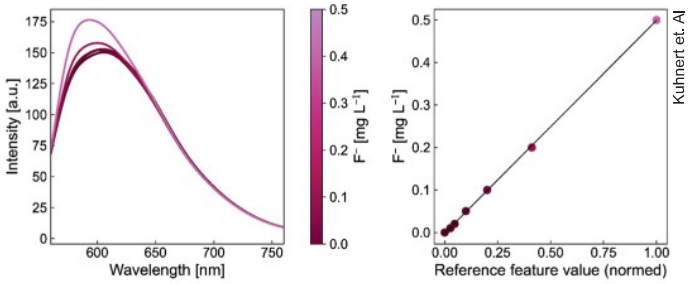
Imaging & Machine Vision Europe: Tell me about yourself and AiDEXA. How did the company start as an imaging and optical technology integrator?

Daniel-Eduardt Sandu: I hold degrees in electrical engineering from the Politehnica University of Bucharest and the Technische Universität Graz, as well as a business administration degree from the Open University.

Throughout my career, I have worked in electronics, sensing, imaging, lighting, photonics and optical instrumentation development. A few years ago, I felt a strong desire to return to making novel things again. This led me to reorient AiDEXA – previously an investment management company with a single shareholding in a local SWIR hyperspectral imaging camera developer – into a boutique builder of Raman spectroscopy instrumentation.

Today, AiDEXA is a mechatronics engineering bureau, specialised in industrial machine vision and optical spectroscopy for material inspection, sorting and grading applications.

We support clients in solving complex material inspection challenges through consulting, engineering and the development and making of tailored spectroscopic solutions. Our core dedication – and persistent obsession – is the design and building of Raman spectroscopy systems.



Kuhnert et. Al

Fluoride emission rate analysis in proton exchange membrane water electrolyser cells: Spectral curves of the individual standards and calibration curve with colour matched dots for the fluoride concentration

Integrating imaging components and optical technologies into our solutions involves a significant amount of hands-on experimentation, iteration and problem-solving. We rely heavily on our own calculations, often using simple spreadsheet models and straightforward mechanical CAD tools. While we have explored advanced optical design software such as Ansys' Zemax and 3DOptix, mastering these tools requires consistent use, supported by ongoing, well-funded projects that enable you to practice, accumulate experience and, eventually, achieve mastership.

The occasional use of such tools, and subsequent limited time investment, hardly justifies the upfront financial investment for such specialist tools. The credo of AiDEXA in this respect is a balanced approach between Monozukuri − the Japanese concept of thriving for excellence in making things − and Jugaad, the Hindi concept of an improvisational style of innovation, based on gut intelligence grown on experience.

IMVE: Could you take me through some case studies where you've applied a spectroscopic solution in an innovative way, and what was the outcome?

DES: In one use case of hyperspectral technology, a client was looking for a sensitive, fast and potentially continuous measurement method for measuring the membrane degradation as used in polymer electrolyte fuel cells or proton exchange membrane water electrolysers. The measurement methods used in the past were either based on cost-sensitive fluoride selective electrodes or expensive HPLC [high-performance liquid chromatography], both needing some hours of conditioning and preparation.

In a joint innovation project, AiDEXA contributed by developing eFLUORIX, an experimental platform for the fast quantification of very low levels of analytes in liquids, by means of spectroscopically resolved photometric measurements. The essential benefit of using hyperspectral technology is the capacity to apply a derivative to the measured spectral profiles. By doing so − and by calculating changes in the slope of the tangent to the spectral profiles − very small spectral changes become visible, enabling us to achieve very high sensitivities.

This novel and validated photometric method enabled very short measurement periods of one minute, with very low fluoride emission detection levels.

In another use case, the challenge was to conduct Raman measurements of tunnel excavation material for soil characterisation in an extremely dusty tunnel environment. To overcome this, we developed a water jet-guided Raman sampling unit, leveraging the laminar flow of water to guide both the excitation laser and the collected spectra to and from the material's surface. This approach is particularly effective since the Raman peaks of water lie outside the fingerprint spectral region relevant for mineralogical identification.

IMVE: When dealing with new clients, how do you manage their expectations of what a vision system can (or can't) do?

DES: Managing client expectations starts with early, clear and honest communication. I believe it is essential to establish a shared understanding and educate the client with humility, recognising that they will not have the same level of specialist knowledge.

For example, on paper, Raman spectroscopy for soil analysis looks promising – there are numerous academic papers on this subject. However, real-world conditions introduce significant challenges, and a controlled lab environment is very different from a real-time sorting application on a conveyor belt in a tunnel.

A key limitation arises when comparing Raman spectroscopy to NIR hyperspectral imaging. While both are hyperspectral techniques, push broom Raman imaging is far more challenging – not because of the spectral unit itself, but due to the laser-based "needle" illumination, which cannot easily replicate the wide-field illumination achieved with broadband halogen sources in NIR systems.

Additionally, certain materials present inherent challenges that cannot be easily overcome. For instance, molasse-rich samples present fundamental physical limitations, and no amount of wishful thinking can override the laws of physics.

Overall, the most important factor in overcoming expectation mismatches is building a good, collaborative partnership between the client, the technology and the engineering providers. Partners working together well will successfully complete any project, even a poorly specified one; partners not collaborating well will eventually ruin even a good project.

IMVE: What types of optical components do you buy, if any?

DES: As a boutique builder of spectroscopic solutions, particularly in Raman spectroscopy and colourimetric scanning, we source a range of optical components essential for our designs. These include lasers and LED modules for controlled illumination, CMOS cameras for detection in the visible spectrum, optical elements such as lenses and filters and optomechanical components for precise alignment and integration. Each component is carefully selected to ensure high performance, modularity and adaptability within our tailored spectroscopic systems.

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

DES: The idea is to design solutions on known physical principles − in AiDEXA's case this includes interactions of light and solid or liquid matter like scattering, absorbance and transmission − with known technologies such as lasers, CMOS detectors, etc. The added value lies in the tailor-made integration of these opto-mechanical-fluidic-electronics technologies into performant products.

AiDEXA

"We are currently in the process of validating the benefits of this novel measurement method. A patent (AT527326A4) has recently been granted for the technology"

AiDEXA

"Providing responses and solutions to anticipated problems is the extra mile that makes good customer service," said Daniel-Eduardt Sandu

"No amount of wishful thinking can override the laws of physics"

In such a design process, the resulting pain points are to create solutions with more or less standard commercially available or cleverly adapted or re-purposed components. We always aim for a modular build-up of functional blocks, enabling the continuous improvement of parts without necessarily changing the overall architecture. And we much appreciate vendors with a high diversity of well-designed and documented products.

At this stage of building experimental first-of-a-kind solutions, costly adaptations of components in minimum order quantities always add an undesirable burden to the financial viability of such projects. We believe it is preferable to invest some time and effort in understanding how and why certain design details are required. In the long run, this will help us not only achieve that perfect design at a competitive price, but also the mastership we are striving for.

IMVE: What's the biggest challenge to growing your vision-related business over the next 12 months?

DES: The broader business environment continues to be shaped by geopolitical turmoil and increasing barriers to global trade, which directly impact both the European and national economic landscape.

However, for small technology ventures such as AiDEXA – meandering in the transition between start-up, scaling up, or winding down – the biggest challenges remain constant: high upfront capex requirements and attracting skilled, qualified people.

As an Austrian, when coping with these challenges I used to visualise the metaphor of climbing to the top of a steep mountain: you need to have good preparation, good partners and previous experience climbing ever bigger mountains. And even, as Reinhold Messner once said when asked if he prefers to mountain climb alone or in a team: "In a team is better, but alone can do it too." Good weather, not too much ballast, staying as nimble as possible, making regular hard choices about what to carry with you, having persistence as you go and preparing for bad weather and accidents. And, as for the expectations, be aware that the top is usually a very odd and desolate place, it is always about getting there.

IMVE: What represents good customer service from vendors? What could they do better to support you?

DES: Providing accurate and prompt technical and/or purchasing information is a minimum expectation from a customer service provider. Whereas, providing responses and solutions to anticipated problems, which the customer is not yet aware of, but about which an experienced professional customer service provider could think might pop-up, is the extra mile that makes good customer service. This ability to think ahead and offer guidance is what sets outstanding vendors apart.

Vendors could enhance their service by going beyond basic support and providing extra knowledge in a readily accessible, digital format. I love the Thorlabs web pages from this perspective, I could spend days on them. Information should be easy to find, instantly available and supplemented with collaborative communication channels that connect customers directly with experienced staff. A seamless blend of self-service resources and expert guidance would significantly improve the customer experience.

IMVE: Where do you find business opportunities?

DES: Being a seasoned professional with some decades of experience in this niche sector has also some advantages, one of them being the presence of a range of contacts with former clients and collaborators. This has been invaluable for AiDEXA, particularly in the early stages of commercial operations in 2018 when hitting the ground running was essential.

Beyond personal networks, Europe offers a robust ecosystem of funding mechanisms for research, innovation and development. Austria, in particular, provides strong national support through programmes such as those supported by the Austrian Research Promotion Agency (FFG), for example, which fosters collaborative projects between academic research and industrial partners.

At this stage – where experimental prototyping is still a key focus – such collaborative, sufficiently-funded innovation projects provide the ideal business setup. They allow small companies to refine niche solutions, build technological expertise – ideally with IP protection – and gradually transition towards broader commercialisation.

IMVE: How do you differentiate yourselves from your competitors?

DES: At AiDEXA, we strive for innovation and daily progress, believing in steady growth through small improvements and breakthrough moments – an ongoing cycle of transpiration, desperation and gratification.

Our approach is rooted in three key principles:

Jugaad (frugal innovation) – we embrace practical, resourceful problem-solving, focusing on effective rather than happy-engineered solutions.
Monozukuri (excellence in making things) – we take pride in craftsmanship, continuous refinement and the pursuit of mastery.
Watch for the cash flow – every project we take on should not only ensure financial sustainability, but also contribute directly to refining and advancing our technology.

Ultimately, the true measure of our competence in building tailored Raman spectroscopy instrumentation is the satisfaction of the clients we serve with dedication and for whom we're prepared to go the extra mile.

IMVE: How important is attending industry conferences and events? Do you plan to attend any over the coming 12 months?

DES: Analytica 2026 is a key event on my radar. I also plan to attend at least one conference focused on Raman spectroscopy or specialised analytical techniques. Occasional direct in-person contact at conferences remains valuable for interacting and learning.

However, I estimate that the importance of traditional trade fairs and exhibitions has decreased in recent years.

The pandemic pushed businesses to explore alternative media and digital engagement, and many have realised the benefits of on-demand access to knowledge and networking opportunities. Similar to how media consumption has evolved from scheduled radio broadcasts to on-demand podcasts, industry engagement in the commercial vendor-to-client area is, I think, shifting towards digital-first interactions.

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

DES: The growth of computer vision, augmented by AI and automation is presently being shaped by three major global trends: geopolitical turmoil, demographic shifts and environmental changes.

I think the following sectors could be among the fastest-growing areas in computer vision:

Autonomous robotics for defence and security: Computer vision-assisted robotics is playing an increasingly crucial role in military applications, including autonomous drones, unmanned ground vehicles and naval surveillance systems. Nations seem to be strongly investing in integrated AI-powered situational awareness, target recognition and automated decision-making for defence systems.

Environmental monitoring and climate response: As climate change intensifies, computer vision in low altitude satellite and drone imagery analysis will increasingly be used for remote sensing, deforestation tracking, wildfire detection and soil health monitoring.

Agriculture and food processing: With increasing food security concerns, AI-driven crop monitoring, precision farming and automated food sorting and grading will gain traction. Computer vision is going to further optimise yield prediction, pest detection and irrigation management.

Manufacturing and industrial automation: The ongoing shift toward Industry 4.0 is fuelling growth in smart factories, quality inspection and predictive maintenance. Computer vision enables further process optimisation with fewer human personnel, improving efficiency and reducing overall waste.

Autonomous vehicles and smart infrastructure: Advanced driver-assistance systems (ADAS) are integrating ever more powerful computer vision for collision avoidance, lane detection and traffic monitoring. Smart cities are also leveraging AI-powered computer vision towards surveillance and smart traffic management systems.

These sectors are advancing rapidly as AI models become more capable, edge computing and 5G networks improve and imaging hardware becomes more sophisticated.

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

DES: The computer vision market will face increasing uncertainty and pressure due to geopolitical instability, economic volatility and global supply chain disruptions. Rising energy costs, regulatory shifts and rapid AI advancements will further challenge companies to adapt. There is a definitive need to plan for resilience. V

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