

VISION

focus

North American machine vision market posts 'record' first half in 2014

Sales of MV components and systems increased 11% to \$1.04bn in six months to June, but growth expected to flatten in second half



New product launches

Emitter based on insect eye shines new light

Bio-inspired design could lead to novel emitters and sensors

VISION Russia expo announced for June 2015

Second outing for Messe Stuttgart supported show and conference

European machine vision sales show strong growth

International demand on the rise, especially in Asia, says VDMA survey, but domestic markets still drag

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Machine vision goes hyperspectral

Collaboration between IMEC and Ximea delivers tiny hyperspectral camera suitable for mass production and deployment on drones and UAVs.

The Belgian microelectronics research institute IMEC and machine vision company Ximea have developed a tiny new camera that combines hyperspectral imaging (HSI) with an ultra-compact optical package.

They say that the result – an xiQ camera from the German firm measuring just 26.4 x 26.4 x 21.6 mm, weighing only 27 g and consuming just 1.8 W – makes the technology practical for deployment on drones for the first time.

Jerome Baron, a business development manager within imec's imaging unit, said that although HSI is not new in the world of high-end remote sensing instruments like

satellites and airborne systems, this new partnership would broaden its applicability greatly.

"It will bring this new technology into the hands of the numerous drone and UAVs companies that want to fly compact multispectral or hyperspectral imaging cameras to serve the emerging precision farming industry," he said.

Mass production

Andy Lambrechts, program manager for imaging & vision systems at IMEC, added that the combination of the research institute's hyperspectral sensor with Ximea's remarkably compact xiQ cameras was "a new milestone".

"The high-speed USB3.0 interface includes power supply over USB that removes the need for expensive and bulky frame-grabbers and separate power supplies," said Lambrechts. "It will enable our partners to design and mass-produce extremely compact hyperspectral imaging camera solutions."

By applying narrow-band spectral filters at the pixel level, IMEC says it has made HSI sensors extremely compact and light, but with the kind of reliability necessary for mass production at low cost.

Three types of standard spectral image sensors are now available: a 100-band linescan design, a 32-band "snapshot" tiled design; and a new snapshot mosaic design featuring 16 bands in a matrix of 4x4 per-pixel filters.

Ximea's xiQ series cameras are said to be the world's smallest for industrial machine vision using the USB3.0 interface. The company uses a single planar rigid board construction to achieve the ultra-compact design, rather than competing multi-board and multifold flexi-rigid PCB approaches.

This is said to make the xiQ easier to integrate into specialized equipment and OEM designs. In addition, the XiQ cameras consume only 1.8 W, easing the power and thermal management design challenges of UAVs.

Ximea's CEO Max Larin said: "This cooperation effectively presents the smallest, lightest, least power consuming and most cost effective solution in hyperspectral field today."

<http://optics.org/news/5/6/9>



Credit: IMEC/Ximea.

Combining broad-spectrum imaging with Ximea's tiny machine vision systems, the technology is said to be highly suited to mass production.

Emitter based on insect eye shines new light

Bio-inspired design could lead to novel emitters and sensors.

The complex optical principles involved in insect vision have become increasingly attractive to developers, who recognize that lenses and sensors based on compound eyes could exhibit specialized imaging behavior which simpler structures cannot match.

Now a team at Pennsylvania State University has approached the issue from the opposite direction, and designed a light-emitter based around a similar compound design in order to determine what its illumination properties might be.

The result turns out to be a better angular distribution of the light than conventional emitters usually provide, and a more uniform scattering. The work was published in *Applied Physics Letters*.

"A compound eye is a remarkable optical device for imaging with a wide field-of-view, and is an appealing structure for miniature cameras and optical sensors," noted the team in the *APL* paper. "The same morphology should also be very attractive, by virtue of reciprocity, to emulate in light-emitting devices for illumination of a broad angular sector."

Testing the theory required some ingenuity, since the diversity of optical elements in a compound eye and the resulting scatter patterns made a computational modelling approach to the problem too complex to be practical.

So instead the team decided to simply work with actual compound eyes, specifically ones formerly owned by the common blowfly. Each optical structure was coated with a layer of fluorescent material, and an ultraviolet

laser used to stimulate emission. Measuring the angular distribution of the visible light being produced allowed the illumination properties of the structure to be quantified.

"It is much easier to just go ahead and fabricate the actual device and see what happens," commented Raúl Martín-Palma of Pennsylvania State University. "We said OK, we can make something artificial using the same replicating structure to emit light in all directions, rather than what we have now which are just planar light-emitting diodes."

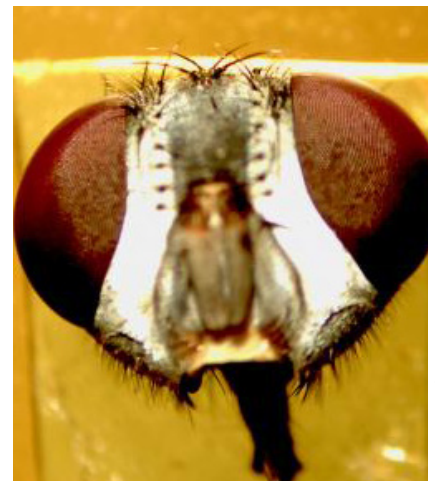
No flies required

Coating a blowfly cornea with a 900-nanometer layer of the fluorescent coating of choice, tris(8-hydroxyquinolino)aluminum also known as Alq3, was achieved using a modified deposition technique called conformal-evaporated-film-by-rotation (CEFR), a relatively low-temperature and non-corrosive technique.

When subsequently induced to emit light by a shortwave UV-laser, the coated structure demonstrated a lesser angular dependence of emission compared to an equivalent flat structure also coated with Alq3, and to scatter light more uniformly in all directions.

The team theorized that the presence of multiple tapered nanonipples,

effectively sub-wavelength structures, in each facet of the compound eye could be behind the change in behavior. An interaction between those sub-wavelength elements and the multi-wavelength-scale facets may nudge the emission towards being more omnidirectional in the forward half of the horizontal plane.



Credit: D.P. Pulsifer/PSU

The position and structure at the micron- and nano-scales of the compound eyes of flies provide them a wide angular field of view.

Real-world applications could eventually benefit, if the increased emission and angular distribution could be adapted into extremely minute light-emitting diodes and detectors, able to process light output and input from a "staggeringly wide field of vision," according to the team.

"We have already developed a technique to mass-replicate biotemplates at the nanoscale, including compound eyes of insects," Martín-Palma said. "So now when we want to make 100 bioreplicated eyes, we don't have to kill 50 flies. We can make multiple copies out of one template."

<http://optics.org/news/5/9/26>

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North American machine vision market posts 'record' first half in 2014

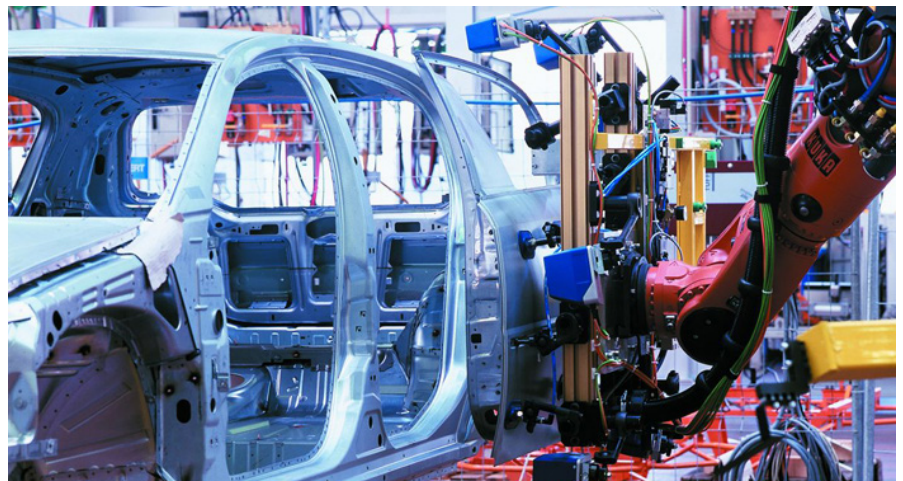
Sales of MV components and systems increased 11% to \$1.04bn in six months to June, but growth expected to flatten in second half.

Total sales of machine vision (MV) components and systems in North America increased 11% to \$1.04 bn in the first half of 2014, according to new statistics issued by trade association the AIA. This is the best first half performance by the North American market since AIA began tracking quarterly statistics in 2009.

Machine vision sales include sales of components and systems; total MV component sales rose 28% to \$155m in the six months to June 2014, while total system sales were up nine percent to \$886m.

The AIA noted that the second quarter of 2014 was "especially strong", posting growth of 30% and 12% for components and systems, respectively. Every component and system category increased in the second quarter of 2014 except for imaging boards. Cameras (41%), smart cameras (34%), lighting (28%), and software (20%) were the standout individual categories in terms of year over year growth for the second quarter of 2014.

AIA President Jeff Burnstein commented, "It is great to see record machine vision sales in North America this year. More North American companies are realizing the benefits of automating with MV, and that is a positive long-term sign for our industry."



North American sales of MV equipment exceeded \$1bn in first half of 2014.

'Flatter prospects'

But Alex Shikany, AIA's Director of Market Analysis, cautioned, "Despite the booming market and manufacturing sector, the AIA membership is tempering its expectations for the second half of the year. Our most recent survey of industry experts shows that the majority of AIA members believe component and systems markets will remain flat in the next six months."

In addition to its quarterly sales tracking report, AIA offers its 2013 Machine Vision Camera Market Study, which is available at a discounted rate to AIA members. AIA also prepares studies on special topics, such as Life Sciences, which it makes available to

all AIA members free of charge on its website.

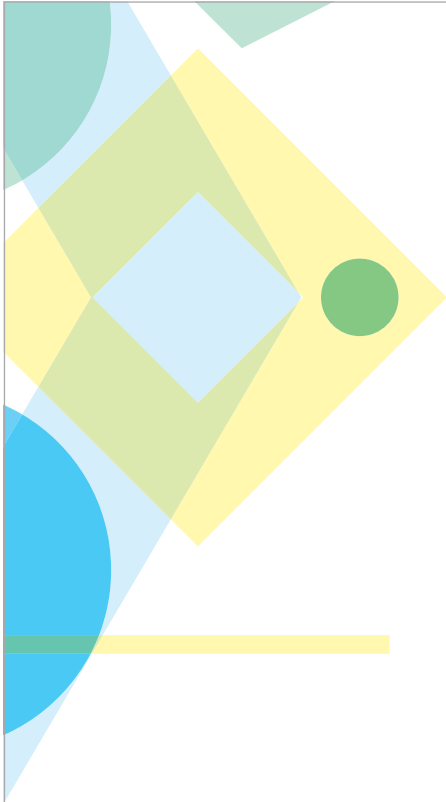
The upbeat North American market report follows German industry group VDMA's generally positive assessment of the European market for vision system sales. In July 2014, the VDMA reported that Europe's MV sector turnover grew more strongly than it had expected – by almost 10% in 2013 and, for 2014, the association expected further annual growth of 12%.

<http://optics.org/news/5/9/8>

About the Author

Matthew Peach is a contributing editor to optics.org.

Photo courtesy of AVM Advanced Vision Marketing und Vertriebs GmbH.



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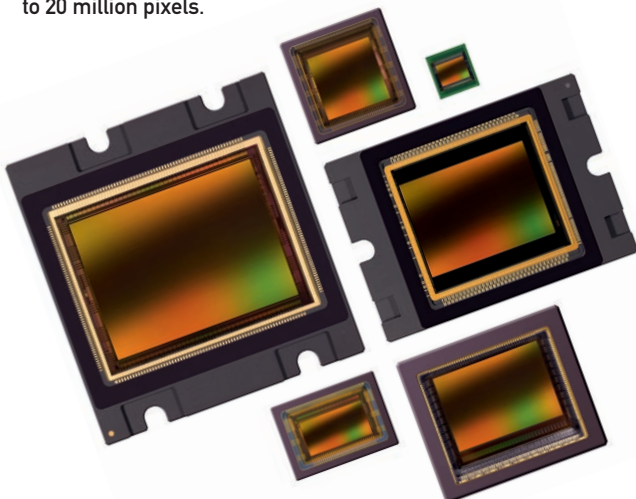


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VISION Russia expo announced for June 2015



Second outing for Messe Stuttgart supported show and conference.

The second Vision Russia Pavilion and Conference, supported by Messe Stuttgart, will be held in Moscow's Expocentre, from June 17 to 18, 2015. The event, said to be the only exhibition for machine vision in Russia will be showcasing and discussing vision systems and technologies with a wide range of industrial and other applications.

As with the 2014 event, next year's Vision Russia will be collocated with SEMICON Russia, a forum for the microelectronics industry in Russia; MV systems are widely used in semiconductor industry for the quality control and testing of silicon wafers and components.

The 2015 event brochure offers several reasons why Russia is a good location to host an MV event: "Russian Government development programs are based on long-term support for innovation; Vision Russia aims to shape complementary industries and conquer the country's untapped machine vision market. Russia has the

third largest monetary reserve in the world, which is being actively invested in hi-tech infrastructure projects. Furthermore Russia is the economic and transport hub for many CIS countries."

2014 show

The VISION Russia Pavilion & Conference was launched in May of this year. Spokeswoman Tatiana Sevostyanova said the debut exhibition offered a new market place with experts visiting from countries including Belarus, Ukraine, Germany, Denmark, Finland, the USA, Korea and Iran. The total number of visitors registered for the two specialized events exceeded 1,500 people.

She stated, "Judging by the key industry players in Russia, the local market for MV systems shows positive dynamics and unlimited potential for the future in both industrial and non-industrial applications. Today, MV systems are in demand by the Russian manufacturing, food processing and

pharmaceuticals industries, while the Western market highlights the opportunity in automotive and electronics sectors. The increase in automation will become the growth driver for the MV market in Russia."

Of the 2014 show, Maxim Soroka, general director of Vitec, a St Petersburg-based industrial measurement and automation company, said, "In terms of global markets, the Russian enterprises competing with European and Asian manufacturers have no other choice – either they will implement machine vision technologies or they will disappear.

"Interest in MV technologies in Russia is growing daily. But it is important to understand that manufacturers of cameras, optics and software can only expect successful business in Russia if they are prepared to invest with patience and to help develop the domestic market."

<http://optics.org/news/5/8/38>

About the Author

Matthew Peach is a contributing editor to optics.org.

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Photonics finance shifting from VCs to corporations



Company presentations

There were plenty of opportunities for potential investors to get a taste of some new photonics talent. Invest in Photonics 2014 featured 20 emerging technology companies from around Europe, which participated in elevator pitch-style funding sessions across the two-day conference program. The selected companies represent a pan-European group of firms, ranging from Finland, Norway, the Netherlands, Spain, Switzerland, Ireland and Hungary, as well as five companies each from Germany and France. Their objective was to improve their chances of raising a total investment of \$90 million (€72m).

Thierry Thevenin, head of the organizing committee at Invest in Photonics, explained, "There were 20 exciting investment opportunities in optical communications, sensing, biophotonics, imaging, energy, healthcare and manufacturing for the VC community to consider at Invest in Photonics this year. We are confident that our emphasis on market-focused data in photonics and real life applications helped the financial community identify the best opportunities to strike deals."

Projects ranged from skin diagnostics and cell analysis to 3D optical printing and smart LED lighting. They covered a hybrid semiconductor graphene material that could potentially replace silicon. The projects also included a bright light therapy treatment to alleviate SAD (Seasonal Affective Disorder).

The companies featured in the special funding session were: Actlight (CH), Aledia (FR), Aurea Technology (FR), Azur Light Systems (FR), Class 5 Photonics (DE), Crayonano (NO), Domo Helios (FR), Effect Photonics (NL), Holografika (HU), Ideas (NO), LED Linear (DE), Luxexcel (NL), Medlumics (SP), Multiphoton Optics (DE), Sicoya (DE), Sunna Design (FR), Sxt-co (IE), Valkee (FI), Volatiles (DE) et Voptica (SP).

<http://optics.org/news/5/10/11>

About the Author

Matthew Peach is a contributing editor to optics.org.

Chairman of Invest in Photonics Giorgio Anania identifies promising investment opportunities as conference opens in France.

As Invest in Photonics (IIP), the international convention focused on photonics business funding and partnering, opened its doors at the beginning of October in Bordeaux, France, Giorgio Anania, chairman of the event said its fourth edition reflected significant change in the investment landscape.

Anania told optics.org, "The traditional venture capital world in photonics has completely died. In fact VC investment in almost any hardware area has died. The VCs are now focused on software and life sciences."

He believes most of the hardware sectors, which were only recently investment targets, are becoming what he calls "zombie sectors" both in the USA and in Europe, although in Asia investment is continuing in hi-tech hardware.

But Anania says it is not all doom and gloom. "Luckily, the corporates have stepped in with a vengeance in the photonics world. In particular, we are seeing massive investment from the giant multinationals with their apparently infinite pockets. I'm talking about the likes of Google, Apple and Samsung. Now they don't do the \$1 million investments with the seed money, so that's not going to happen any more."

Outspoken

As evidence for his characteristic outspoken views about the ups and downs of the photonics business, Anania cited a few examples. "In May 2014, Luxvue – a developer of micro display applications - was acquired by Apple for a rumoured \$1 billion. Another case was the August 2013 acquisition of Novaled by cash-rich Samsung."

"Who is hiring photonics engineers nowadays? In large numbers, it's the likes of Google, Apple, and Samsung. If you look at what Samsung Ventures can put on the table, it's probably \$1.2 billion per year. Apple is not just investing in photonics, it is hiring photonics engineers to bypass the VCs. Google is hiring more PhDs in silicon photonics than all of the silicon photonics companies. It's a very different landscape from five years ago."



Giorgio Anania: Invest In Photonics 2014 Chairman.

So in which photonics-related markets does Anania think there is still serious money to be made? "Photonics is ready to go into a lot of new consumer application areas and it is clearly starting to happen. In lighting for example it's going to be a real revolution that is just starting. There are display applications – the Google Glass equivalents.

"Transportation and cars: we will keep the car's shell but the inside it will be cluttered with all sorts of sensors with a lot of roles for photonics. In life sciences, there are developments such as non-invasive sensing. But surprisingly a lot of VCs don't seem to know how to make it happen at the moment so they seem to be retreating in a lot of these areas."

Anania also has some pithy advice for the VC sector which historically was so enthusiastic about photonics opportunities: "The VCs that are coming to Bordeaux or looking at this sector in general need to wake up a little bit. I will certainly be trying to wake them up in the IIP discussions. They are really missing the boat.

"Nowadays, for photonics companies that are already more advanced, the corporates are stepping in. They used to be involved at later stages of company development but now they are becoming involved at an earlier stage – but not so early that they get involved with all of the seed-funding where the VCs used to do so there is a danger of a disconnect."

Photo: Matthew Peach

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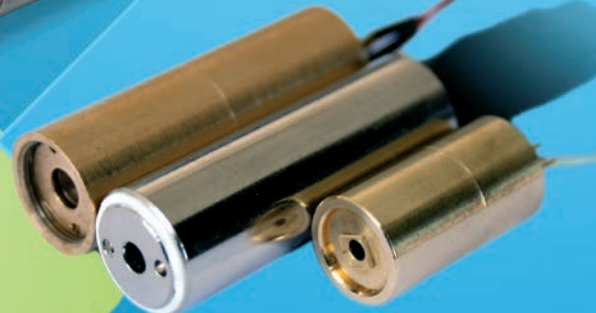
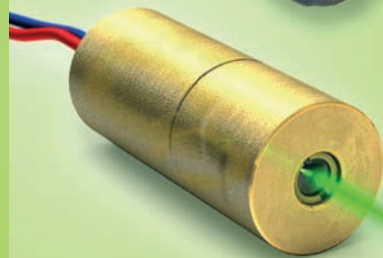
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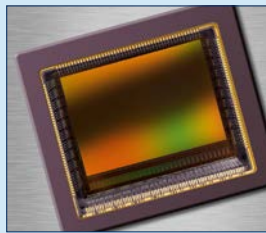
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European machine vision sales show strong growth

International demand on the rise, especially in Asia, says VDMA survey, but domestic markets still drag.

The European machine vision (MV) industry is in “an excellent condition”, according to the German VDMA’s latest market survey, published earlier in July. It states that the MV sector’s turnover grew more strongly than initially expected – by almost 10% in 2013 and for 2014 the VDMA expects a further growth spurt of 12%.

“This is great news for our industry,” said Donato Montanari, Board Member of VDMA Machine Vision and general manager of the MV business unit at Datalogic Automation at last week’s VISION press conference in Reutlingen, Germany.

Non-industrial applications, manufacturing

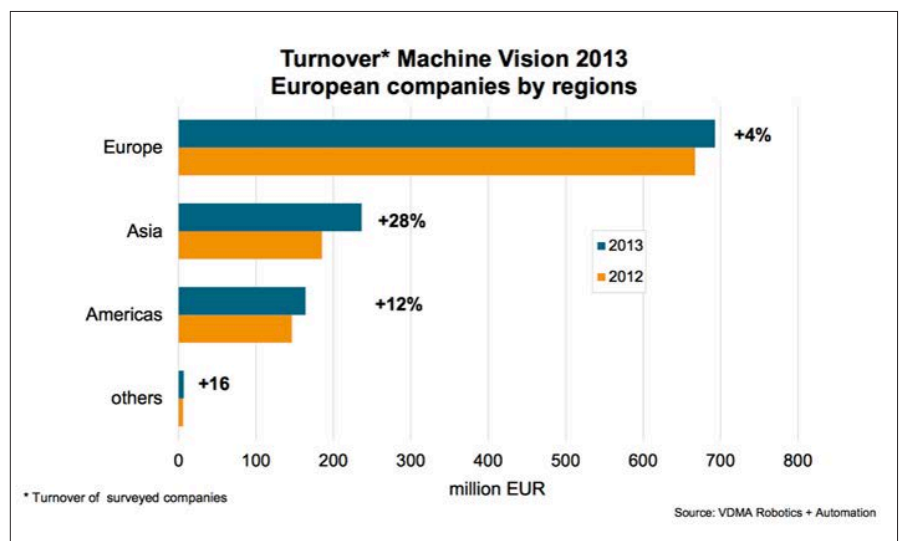
The survey reports that European suppliers of MV technology have benefitted from strong demand in both manufacturing and the non-industrial application fields. In keeping with the general trend of recent years, 2013 saw the biggest growth – an increase of 19% – in the non-industrial area. Intelligent traffic systems and medical technology gave the biggest impetus for growth.

Montanari added, “The versatility of MV as a problem solver is a strong driver for growth. New applications are constantly developed, boosting demand. The lion’s share of our business, however, is still generated by the manufacturing sector, which grew by 6% in 2013.”

The VDMA believes that there is “a renaissance of industrial production in many European countries and the USA”, which will create stable demand for MV technology in the coming years. In 2013, the automotive industry was the biggest customer for machine vision with a 22% share of total turnover. This was followed by the electronics and the electrical industry including semiconductors (14%) and the food and beverage industry (6%).

makers of application-specific and configurable systems grew their turnover by 12% and the recorded volume reached €436 million.

Manufacturers of compact systems, such as intelligent cameras and vision sensors, expanded sales by 20%, to just over €100 million. By contrast, the MV components business grew by



International sales

In 2103, the European MV companies in the survey recorded their strongest growth in Asia: an increase of 28% over 2012. China accounted for approximately 9% of business. Montanari said, “More than a quarter of European MV sales are in Asia and we still expect this to grow further.”

While domestic demand for the European MV providers grew by a modest 4% in 2013, North America bought almost 13% more vision technology from Europe. The recovery of Europe is noticeable but happening at a slower pace than in the US, where substantial investments in the modernization of production facilities are increasing competitiveness. The aim is “re-shoring” manufacturing that had been previously moved to lower wage regions.

Last year, MV system sales outpaced the components business. European

only 6%. The largest product category, cameras, increased sales by 8%, while the fastest growing components category was frame-grabbers. European grabber makers saw their business rise by almost 9%, mainly for high-speed and high-end applications.

The German MV industry increased its turnover by 8% in 2013 totalling €1.6 billion, said the VDMA. Growth impetus came mostly from exports: while domestic turnover stagnated, exports rose by 15% and export share edged up from 55% to an all-time high of 58%. This growth led to an increase of employment in this sector by 9%.

Montanari commented, “Due to a favorable order intake in the first half of 2014, we expect German MV suppliers to grow sales volume by 10% this year, and turnover to exceed €1.8 billion.”

continued on page 16

continued from page 15

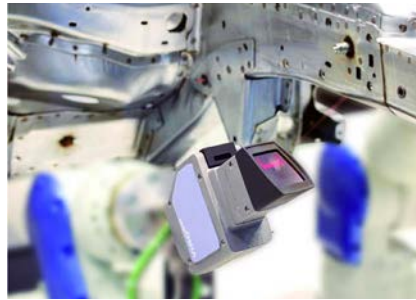
European machine vision sales show strong growth *continued*

Embedded vision systems sales growth forecast

Another new vision sector market analysis, conducted by IHS Technology, forecasts that shipments of embedded vision devices in the automotive, industrial automation, physical security and business intelligence markets will exceed 14 million units in 2018, up from almost four million units in 2014. Embedded vision systems utilize a combination of embedded systems and computer vision, which allows devices to use video inputs to better capture and understand their environment, and apply logic and decision making processes to video signals.

The IHS technology report comments,

"The maturity of embedded vision algorithms varies by application market. For instance, while embedded vision technology has been active for some time in physical security and industrial automation markets, the consumer sector represents more of an emerging opportunity."



However, despite the synergies in algorithm requirements across diverse application markets, there are still "very few vendors active across multiple applications", the analyst adds. In some markets, like automotive, the long sales cycles and high qualifying requirements have limited new competition. In others, such as

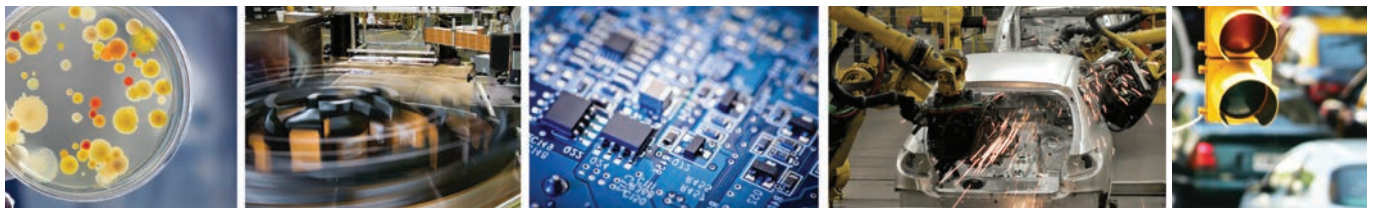
physical security, the fragmented equipment market means that algorithms need to be optimized for a large number of products, which can act as a barrier to new entrants.

"While the software and hardware vendors in embedded vision are not expected to move into every application market soon, developments in the automotive space, in particular, should help spur more accurate and reliable algorithms across the embedded vision industry," says the analyst. "This trend, combined with increased awareness in the consumer market for augmented reality and gesture recognition, means that demand for embedded vision devices will grow rapidly in the decade ahead."

<http://optics.org/news/5/7/25>

About the Author

Matthew Peach is a contributing editor to optics.org.



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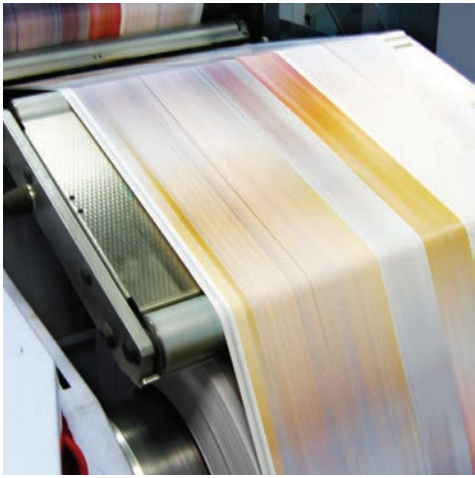
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Hyperspectral imaging reveals Finns' life in Stone Age

Analysis poses new questions about early peoples' movements around the Baltic during Neolithic era.

Clay figurines at least 5,500 years-old, which were discovered during archaeological excavations in Vantaa, Finland, in summer 2014, have recently been scanned with Finnish company Specim's hyperspectral camera. An archaeologist believes that the results reveal new possibilities of shifts of people in the Neolithic time.



Archaeologist Jan Fast (center) studying the thousands of years-old Vantaa clay figurines in Specim's lab in Oulu, Finland.

The imaging revealed that clay in the figurines was similar to clay in the ground at the excavation site. The figurines were scanned with Fenix, the full-spectral sensor installed in the SisuROCK scanner, which is similar to the AisaFENIX, the full-spectral sensor designed for remote sensing.

The archaeologists' theory that the bigger of the two figurines would have been used as an oil lamp could not be verified. Spectral signatures of seal blubber, which is still used

in oil lamps by indigenous peoples inhabiting the Arctic regions, were absent from the spectral profile of the figurine. There were no traces of other organic materials such as blood on either of the figurines. However, the absence of the traces does not mean that they were not used; they may have disintegrated over the millennia.

The conclusions were made by comparing spectral profiles of figurines and reference samples. "It was interesting to notice that the method is suitable for the analysis of archaeological finds," commented archaeologist Jan Fast, who brought the figurines to be scanned at Specim in Oulu.

"The analysis of the spectral profiles gave rise to several new questions regarding contacts in the Baltic Sea region during the Neolithic era, the manufacturing techniques of the figurines as well as their ritual use."

More on Pre-Stone Age Finland and the movement of peoples can be found here.

The scanning of the figurines was done as pro bono work at Specim. Georg Meissner, the company's managing director, commented, "The scanning of these archaeological figurines was very exciting for us and gives us an opportunity to show how valuable spectral imaging is in research and investigative work. We are a leading hyperspectral camera manufacturers and our business is growing stronger than ever with more product launches coming during this and next year."



The larger of the two figurines could have been used as an oil lamp.

About Specim

In the early 1990's, following more than 10 years of intensive scientific research done by Finland's VTT Technical Research Centre, the Specim founders designed the first professional hyperspectral spectrographs and imagers. These first commercially available spectrographs were developed in close collaboration with NASA to meet the requirements of the most advanced applications in remote sensing.

So far, Specim has delivered more than 4000 instruments and spectrographs.

Jan Fast describes his team's research into the Stone-Age Finnish clay figurines in this video:

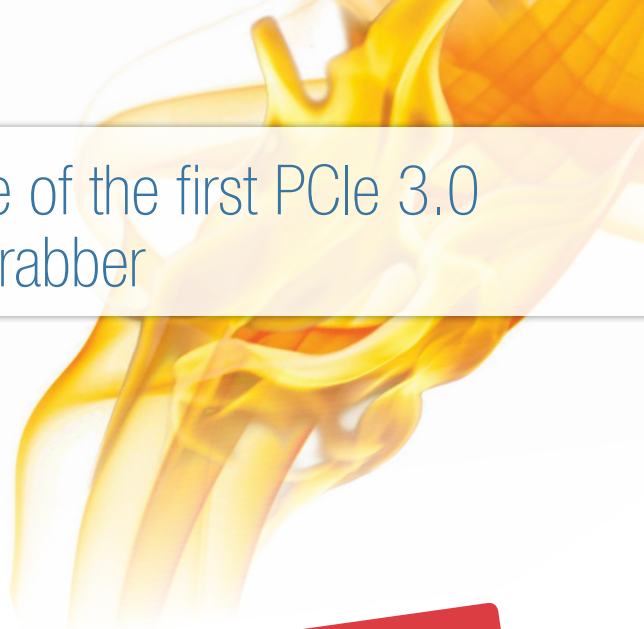
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(in Finnish).

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About the Author

Matthew Peach is a contributing editor to optics.org.

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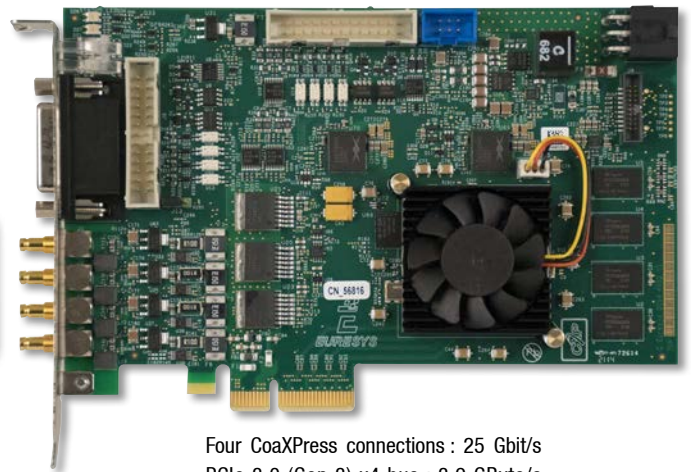
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