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## AI-enabled video analytics at the edge

Avnet Integrated's intelligent-vision, market-ready solution optimizes design and reduces time to market

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#### INTRODUCTION

Avnet Integrated's innovative intelligent-vision technology platform is based on powerful embedded computing technologies and the use of artificial intelligence (AI). The market-ready solution is designed for deep learning supported video analytics tasks at the edge.

The ready-to-use system platform includes powerful hardware components and software with optimized AI. The AI functionality enables intelligent processing of large amounts of data and recognition of recurring patterns, as well as self-learning analysis and evaluation in order to generate reliable decision-making support.

The intelligent vision platform enables quick and easy evaluation and testing of various video analytics functions on the basis of preconfigured functional building blocks. This creates the prerequisite for reducing the development effort for a specific application. The customer can bring their Al-based, high-performance end product to market relatively quickly and at optimized cost.

Al can be easy to use with Avnet Integrated's intelligent solutions and extensive support. With 100 years of experience, partners like Intel and Avnet's complete ecosystem to support you, your next Al innovation is within reach.

#### AI'S POSITION IN THE GLOBAL MARKETPLACE

Computer vision solutions account for a significant share of the global market for future promising applications based on artificial intelligence. On the basis of digital camera and video recordings as well as AI models, machines can identify and classify objects and persons, and execute resulting actions.

Leading market research institutes forecast high annual growth rates for the computer vision market worldwide. By 2026, revenues are estimated to grow to over 11.8 billion – up from 11.8 billion in 2019.

Computer vision solutions are extremely diverse, with applications in security controls, manufacturing automation, warehouse optimization and inventory control, traffic flow optimization, point-of-sale systems and advertising.



Figure 1. Common areas of application for computer-vision solutions

#### **EVOLVING METHODS AND TECHNIQUES OF AI**

The meaning of the term "artificial intelligence" has changed with the development of technology and applications. What was called Al in the early years would today be thought of as an average program.

The idea that machines could solve different tasks and process abstract concepts – and even constantly improve themselves – led to the first use of the term "artificial intelligence" in 1956. Throughout the evolution of AI, the methods of the individual

stages of development have influenced and complemented each other.

The development of programs based on algorithms has become increasingly complex in recent years. With new applications, demands on the scope of performance increased and diverse requirements must be met. Due to the complexity and the scope of performance, AI-based systems have also become more independent.



Figure 2. Artificial intelligence, machine learning and deep learning

Al is technology that enables machines to imitate human intelligence. Programs have the ability to learn and to act in accordance with the acquired knowledge. Machine learning comprises algorithms with the ability to learn without being explicitly programmed. A subarea of machine learning is deep learning that makes use of many layers of neural networks and a large amount of data to improve data analysis without human intervention.





Figure 3 compares traditional programming and machine learning, whereby the algorithm is continuously improved by feedback loops.



The example of image recognition with deep learning in Figure 4 shows which tasks are performed by the cloud or the data center and which functions take place at the edge.

Live data is recorded and prefiltered in the edge environment. In order to comply with the General Data Protection Regulation (GDPR), all incoming data are already anonymized here at the edge. Only reduced and anonymized data are transferred to the cloud via the network.

The edge will become increasingly important in the future because the amount of data will increase, and it is here that the data can be processed most rapidly with high reliability. The most important parameters of the edge are bandwidth and latency or delay time, which indicate how quickly a person or object is detected.

## AVNET INTEGRATED'S INTELLIGENT-VISION PLATFORM IMPROVES AI

Computer vision combines smart cameras, edge- or cloud-based computer technologies, software and artificial intelligence for the realization of systems that can detect and identify people and objects. By using deep learning technologies, image processing and analysis systems can be continuously improved. Avnet Integrated's intelligent vision technology platform is designed for deep learning supported video analytics tasks at the edge. The platform enables reliable motion analysis. One example is capturing individual persons or groups of people and creating a heat map of people within a defined space. Furthermore, the functional platform is ideally suited for object detection and tracking, positioning, various counting tasks, vehicle recognition and automatic number plate recognition.

![](_page_4_Figure_3.jpeg)

Figure 5. The technology platform is the basis for optimized functional platforms.

Avnet Integrated's intelligent vision platform is the basis for functional platforms that can be optimized for different tasks.

The core of the technology platform is a powerful embedded module, developed and manufactured by Avnet Integrated in Germany as a standard module. The module concept ensures that new processor technologies are quickly available. A direct migration path to new CPU technologies is possible by simply replacing the module. Design and qualification of the applicationspecific carrier board needs to be performed only once and can remain unchanged over many years. Al-based systems such as video analytics require a very powerful embedded module. For these high-performance applications, the COM Express<sup>™</sup> standard for computer-on-module (COM) has been successfully established for years and has proven its usability in countless applications.

The intelligent vision platform is equipped with the extremely powerful COM Express™ Type 6 module of the MSC C6B-CFLR family from Avnet Integrated, which is based on an Intel® Core i7 or Intel® Xeon™ processor. The standard module is designed especially for applications where a large amount of data is generated that must be processed by the on-board processor. Customers also have the option to configure a system platform tailored to their requirements. The technology platform can integrate various accelerator technologies for fast data processing at the edge. A key requirement for the Al accelerator is low power dissipation. Depending on the specific application, the number of video channels and the latency time play roles.

Intel offers a rich portfolio of Al accelerator technologies. The solutions range from Al inferencing on powerful CPUs, graphics processing units to the optimized Intel® Movidius Vision Processing Units (VPUs). The VPU can process two video channels at a power of 2.5 watts. Up to eight Intel® Movidius VPUs can be placed on the Al accelerator card. This Intel technology offers a particularly high inference performance per watt of power dissipation.

![](_page_5_Figure_2.jpeg)

Figure 6. The Intel® Movidius VPU (source: Intel)

Two suitable IP cameras are part of the technology platform. Power over Ethernet support and Wi-Fi functions are available for fast connection of cameras. The software package is optimized for corresponding functions in intelligent video analytics at the edge and uses the Intel® Open Visual Inference and Neural Network Optimization (OpenVINO) toolkit for this purpose.

#### MARKET-READY SOLUTION: PEOPLE DETECTION FUNCTIONAL PLATFORM

Avnet Integrated's functional platforms are a combination of optimized hardware, software and service providing out-of-the-box experience for dedicated use cases of customers in different markets. The hardware basis on which to build dedicated functionalities is Avnet Integrated's intelligent-vision technology platform.

Avnet Integrated's first market-ready solution – our people detection functional platform – is a combination of a tailored computer vision technology platform and a dedicated software framework providing intelligent video analytics at the edge. MRS provides an easy out-of-the-box solution and enables the design of smart deep-learning-based end products.

![](_page_5_Figure_8.jpeg)

Figure 7. Avnet Integrated's people detection functional platform provides intelligent video analytics at the edge. The deep learning video analytics at the edge improve operational efficiency and security in different verticals like retail, industrial, banking, education and public safety through:

- people detection
- people counting
- behavior analysis
- object detection

GDPR-compliant face recognition/reduction functionality is an option.

#### **EXAMPLES OF AI-DRIVEN INNOVATIVE APPLICATIONS**

Avnet Integrated's new all-in-one AI box is perfect for security, surveillance, manufacturing, machine vision and logistics solution providers. People- and object-detection functionality drive versatile future applications. Here some examples.

Visual recognition and counting of people in (industrial) infrastructure to improve safety	Simultaneous analysis of large video surveillance and real- time identification of dangerous situations	Monitoring of personnel attendance at sites of critical infrastructure or industry applications through face recognition to improve operational efficiency	Intelligent visual monitoring of industrial terminals
Al-supported visual product counting in automated production processes	Automated visual protection and surveillance of bounded areas or intrusion detection	Visual identification/recognition if a person falls onto the tracks in a railway station to automatically report the incident, thus improving accident prevention and emergency response	ldentification of objects in the surrounding of wind turbines and airports to avoid damage
Intelligent automated data collection, like counting to understand/analyze traffic flows	Visual automated monitoring of critical infrastructure, detection of motion or other incidents	Detection of objects and humans to improve security by preventing intrusion into areas such as runways, control rooms, airplane hangars and other secured zones	Automatic recognition of high crowd density in production or retail areas

#### **SELECTED USE CASES**

These use cases describe three typical applications for Avnet Integrated's people detection market-ready solution.

![](_page_7_Picture_2.jpeg)

Figure 8. Counting of people in a defined area

### Visual counting of people

The requirement is to determine the number of employees in a defined area of a factory in order to capture and record manufacturing capacities and optimize production processes. Compliance with distancing regulations can help ensure safety. Over time, the results can influence the future redesign of workplaces and restructuring of the working environment.

With the help of one or more cameras, the people detection market-ready solution can count the number of people present in a work area. Anonymized monitoring can be used to automatically generate a reliable report, without any need for personnel.

![](_page_7_Picture_7.jpeg)

Figure 9. Detection of people in safety-critical zones

# Detection of unauthorized access by a person

Safety monitoring of extensive- or safety-relevant areas, such as warehouses, production plants, buildings or critical infrastructure, requires a high level of human resources. Nevertheless, virtual or visual safety limits must be monitored and maintained to prevent accidents caused by persons or objects in the danger zone. The situation is especially critical in the case of people who are in the direct vicinity of moving machines or vehicles.

Visual monitoring in real time allows rapid detection of people in safetycritical zones. After an event has been detected, appropriate actions can be initiated, and a hazard report compiled.

![](_page_7_Picture_12.jpeg)

at mobile machines

# Monitoring the area of movement of a mobile crane

The constant monitoring of areas of activity of commercial vehicles and mobile machines is currently implemented in many cases in a stationary manner - with light barriers, for example. These solutions are not flexible and involve a great deal of effort.

With the people detection platform, the entire dynamic area of movement can be automatically monitored in real time and hazardous situations can be detected. For this purpose, the platform and the camera are mounted on the mobile crane. A critical situation can be immediately shown via a driver display or a redundant safety system. The aim is to improve safety and prevent accidents.

#### **AVNET INTEGRATED CUSTOMER SUPPORT**

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Avnet Integrated has many years of expertise in combining hardware and software with AI and supporting our customers in all phases of implementing their innovative products.

We develop and manufacture high-performance hardware in our own design centers and in highly automated production facilities in Germany. In addition, Avnet Integrated has extensive software expertise both within the company itself and within its parent company, Avnet. In order to be able to offer the complete Al ecosystem, Avnet Integrated works together with leading industrial partners such as Intel. We're ready to bring Al to your next innovative solution.

#### READ MORE ABOUT AVNET INTEGRATED'S MARKET-READY SOLUTION.

## FIND MORE INFORMATION ABOUT INTEL'S EMBEDDED SOLUTIONS AT <u>WWW.INTEL.COM</u>.

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