Machine vision in factory

Overview

November 2021
Omdia ecosystem

Omdia serves manufactures, software and service providers by providing insight into end-user markets throughout the supply chain.

Vertical markets & End-users

Machine vision

SAS providers

amazon  Apple

Google  Microsoft

Johnson Controls

Machine vision

BASLER

ZEBA

Cognex

SONY

OMRON

Panasonic

OMDIA
Omdia ecosystem

- Provides intelligence, industry forums and marketing services to the technology industry.
- Leverages an events business that brings vertical expertise across horizontal areas.

Key value propositions include:

- Identifying industrial and regional technology trends
- Highlighting market share players
- Outlining opportunistic market segment and applications
Machine vision

- Hardware (Major product types)
- Software (AI/ML in factory/warehouse automation)
- Applications (Supply chain transparency)
Definitions

**Machine vision in factory/warehouse automation**

- Machine vision enables computers to interpret and analyze the visual world, simulating the way humans see and understand their environment. It applies the synergy of software and hardware to identify and classify objects in digital images and videos, then lets computers react to what they see.

- Ultimately this is done to automate various tasks whilst ensuring quality, safety and other performance metrics applicable to a manufacturing or industrial environment.

Machine vision as a combination of hardware and software solutions exists in a variety of global markets and are broadly categorized by the following:

- Factory automation/warehouse automation *(Industrials)*
- Physical surveillance, defense and aerospace, smart cities *(Security)*

Software and AI markets

- Others *(Retail/consumer, financial, governance non-industrial)*

*‘Every factory must have ways to ensure the quality of its products in the initial design, fabrication, and final inspection phases’*
Machine vision: Key takeaways

1. **Machine vision hardware**
   Trending market environments are favoring more flexible and mobile solutions. Flexible and versatile non-PC based vision systems are in higher demand.

2. **Machine vision software**
   AI/Machine learning functionality is becoming more ubiquitous in current solution offerings. Greater utility is allowing for more deployment across more complex applications.

3. **Application use-cases**
   The transition to smart factories and warehouses of the future will come primarily from more flexible vision solutions leveraging edge and AI analytics.

4. **Regional markets**
   Machine vision deployment is heavily concentrated in technologically advanced regions and countries. Germany, the US, China and Japan are central hubs of innovation and deployment.

5. **Mergers, partnerships and acquisitions**
   Economic depressions from COVID-19 has resulted in low interest rates across key regions. As a result of mass M&A activity the overall landscape for machine vision is increasingly dynamic.
Key figures

$4.75 B
Machine vision industry revenue

4.3%
Global Hardware CAGR

13.1%
Global Software CAGR

43.5%
Top 10 market share players

2020 edition report figures
Automation overview

- **PC based vision**
  - Vision systems interfaced with a PC offering no onboard analytics (Machine vision camera)

- **Embedded vision**
  - Vision systems offering onboard analytics (Smart camera, smart sensor, embedded vision system)

- **Vision peripherals**
  - Components used to improve vision quality (Lighting, frame grabbers, lenses)
Machine vision hardware market

Smart sensor
smart sensors are an electrical, opto-electrical, or electronic devices consisting of sensitive lens and lighting components to perform a single machine vision task. Smart sensors can be embedded and also interfaced with a PC system.

Embedded vision system
Embedded systems are a compact form of vision. These systems can support multiple cameras and peripherals through common interface protocols and are based on a processor module with or without housing.

Frame grabber
Frame grabbers are a device (PCB card) used for interfacing the video output from a camera with a PC or other control device. These devices are sometimes called video capture boards or cards. Functionality ranges from a simple interface to a more complex device that can handle many functions including, triggering, exposure rates, shutter speeds and others.

Machine vision camera
A traditional smart camera is a single unit that incorporates a machine vision camera, a processor, and lighting in a compact enclosure. Smart cameras can capture and analyze images/data without the explicit need of a PC.

Machine vision peripherals
Machine vision peripherals are essential for many traditional vision inspection tasks. These include a variety of lenses and lighting solutions which help increase the fidelity of images/video captured.

Hardware global market

- **Smart sensor:** 5%
- **Embedded vision system:** 17%
- **Frame grabber:** 13%
- **Machine vision camera:** 37%
- **Machine vision peripherals:** 21%
• **Library Software consists of an environment in which the user can develop their own MV system architecture.**

• **System Software is designed pre-sale for a specific application.**

• **Open-source vision tools**
  – Over 30,000 global companies are using open-source tools

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**Open source vision user market**

- OpenCV: 22%
- Keras: 19%
- IBM Watson: 17%
- Apache Mahout: 10%
- KNIME: 5%
- Others: 27%

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**Machine vision software market, 2020 edition**

Revenue growth %

- 2020: 22%
- 2021: 19%
- 2022: 17%
- 2023: 10%
- 2024: 5%
- 2025: 27%

Source: Omdia
Software trends

• Why is AI important
  – We still have many applications that are currently too difficult to cope with utilizing traditional machine vision techniques and technologies
  – The number of variables are too great so ‘brute force’ methods such as writing explicit code and designing systems for specific tasks tend to result in large amounts of inefficiency and poor results.

Artificial intelligence – Where are we today

• Machine learning
  – Machine learning is the study of computer algorithms that can improve automatically through experience and by the use of data.

• Deep learning
  – Extract useful patterns from data Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised.

• Convolutions neural networks
  – In deep learning, a convolutional neural network is a class of artificial neural network, most commonly applied to analyze visual imagery.
### Industrial landscape

<table>
<thead>
<tr>
<th>Industry</th>
<th>World, 10%</th>
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<tbody>
<tr>
<td>Automotive</td>
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<tr>
<td>Chemical</td>
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<tr>
<td>Machinery</td>
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<td>Robotics</td>
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<td>Utilities</td>
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<td>Other industries</td>
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</tbody>
</table>
## Regional landscape

<table>
<thead>
<tr>
<th>Region</th>
<th>Share of World Market</th>
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<tbody>
<tr>
<td>Austria</td>
<td>World, 5%</td>
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<tr>
<td>Germany</td>
<td>World, 5%</td>
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<tr>
<td>Italy</td>
<td>World, 5%</td>
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<td>Portugal</td>
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<td>Switzerland</td>
<td>World, 5%</td>
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<tr>
<td>Turkey</td>
<td>World, 5%</td>
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<tr>
<td>Canada</td>
<td>World, 5%</td>
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<tr>
<td>Rest of Latin America &amp; the Caribbean</td>
<td>World, 5%</td>
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<tr>
<td>China</td>
<td>World, 5%</td>
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<tr>
<td>India</td>
<td>World, 5%</td>
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<td>Benelux</td>
<td>World, 5%</td>
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<tr>
<td>Greece</td>
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<tr>
<td>Nordic Countries</td>
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<tr>
<td>Russia</td>
<td>World, 5%</td>
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<tr>
<td>UK</td>
<td>World, 5%</td>
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<tr>
<td>Rest of Middle East and Africa</td>
<td>World, 5%</td>
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<tr>
<td>Mexico</td>
<td>World, 5%</td>
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<tr>
<td>Japan</td>
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<td>Singapore</td>
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<td>South Korea</td>
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<td>France</td>
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<td>Poland</td>
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<td>Rest of Europe</td>
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<td>Brazil</td>
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<td>US</td>
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<tr>
<td>Oceania</td>
<td>World, 5%</td>
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<tr>
<td>Rest of Asia &amp; Oceania</td>
<td>World, 5%</td>
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</tbody>
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The machine vision application market is comprised of various hardware(s) and software(s) working together to create a solution. The machine vision applications market is outlined by 9 major categories; varying in regional distribution based upon country level industrial output.

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>High speed inspection</td>
<td>10.00%</td>
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<tr>
<td>Multispectral/hyperspectral imaging</td>
<td>10.00%</td>
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<tr>
<td>Defect/flaw detection</td>
<td>10.00%</td>
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<tr>
<td>Bin picking</td>
<td>10.00%</td>
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<tr>
<td>Camera mobility</td>
<td>10.00%</td>
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<tr>
<td>Collaborative robotics</td>
<td>10.00%</td>
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<tr>
<td>Embedded vision</td>
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<tr>
<td>Miscellaneous vision inspection</td>
<td>10.00%</td>
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<tr>
<td>Others</td>
<td>10.00%</td>
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## Additional coverage

<table>
<thead>
<tr>
<th></th>
<th>Section Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Regional analysis by country</td>
<td>Key regional coverage by various hardware, software, and application trends</td>
</tr>
<tr>
<td>2</td>
<td>Industrial segmentation by country</td>
<td>Further breakdowns of key industrial verticals: Automotive, semiconductors, electronics, food &amp; beverages, healthcare, chemicals and pharmaceuticals, and others</td>
</tr>
<tr>
<td>3</td>
<td>Machine vision software</td>
<td>Analysis covering the emergence of AI and the role of machine learning in current and future markets</td>
</tr>
<tr>
<td>4</td>
<td>Machine vision product use cases and case studies</td>
<td>Camera use cases across vision horizontal markets and industrial case studies</td>
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<tr>
<td>5</td>
<td>Machine vision deployment, machinery production tracker and industrial automation tracker highlights</td>
<td>Top level highlights of key machine vision forecast variables</td>
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</tbody>
</table>
Appendix

Author
Alexander Bourgeois, Senior analyst, Government & Technology
askanalyst@omdia.com

Further reading
Machinery Production Market Tracker– 2021 (Quarterly Q1 April 2021)
Industrial Automation Tracker– 2021 (Quarterly Q1 April 2021)
Video Surveillance & Analytics Database – Data (July 2021)

Omdia Consulting
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Machine vision scope

- This report is a study of global machine vision in factory automation. It outlines the machine vision market into various vertical segments: hardware, software, services, accessories, and applications with regional and industrial segmentation. Sales revenue and unit shipments of new equipment are included in this data, specified by the ISIC, NAICS, and NACE industrial sector codes. The data does not include revenue derived from other sources including:
  - Service or equipment warranty
  - Distributer/integrator markup
  - Equipment repair, and options after the initial sale

- In this report, the market is measured at the point of sale (POS) from the OEM. Omdia works closely with vendors and suppliers to identify all the revenue reflected in this report.
  - Base year: 2020
  - Annual forecast years: 2021–25
  - Region: World
  - Market size estimates and forecasts in revenue, unit shipments, and average selling price (ASP); segmented by category/product type at global, regional, and sub-regional levels
  - Market share estimates for 2020 for machine vision at global and regional levels
The Machine vision in factory automation study is based on a primary research methodology which utilizes first-hand interviews and questionnaires from machine vision market competitors. All revenue(s) and unit(s) data is collected by hardware, software, and regional verticals. A five-year forecast is provided based upon relative trends and relevant automation market indicators.

- Machine vision global market size
- Market shares by hardware products and software categories
### Machine vision hardware

<table>
<thead>
<tr>
<th>KEY ISSUES ADDRESSED</th>
<th>KEY MARKET FORECASTS</th>
<th>COVERAGE</th>
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<tbody>
<tr>
<td>What is the current state of the global machine vision hardware market?</td>
<td>Smart sensor revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>Industry Segments</td>
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<tr>
<td>What key market trends are affecting the growth of the hardware market?</td>
<td>Smart camera revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Automotive</td>
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<td>How will the market develop through 2025?</td>
<td>Machine vision camera revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Building automation</td>
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<tr>
<td>What are the major drivers of market growth and the key challenges faced by the industry?</td>
<td>Frame grabber revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Chemical</td>
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<tr>
<td>What are the bottlenecks in technology development for machine vision hardware?</td>
<td>Embedded machine revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Food and beverage</td>
</tr>
<tr>
<td>What are the key market players and what are their products and services?</td>
<td>Machine vision lighting revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Machinery</td>
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<tr>
<td>What are the strategic recommendations for market participants?</td>
<td>Machine vision lenses revenue/ASP/units by Industry, region: Forecasts 2020-2025</td>
<td>• Medical</td>
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<td><strong>Hardware Categories</strong></td>
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<td>• Smart sensor by colour capacity, scan type</td>
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<td>• Smart camera by colour capacity, scan type, sensor technology</td>
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<td></td>
<td>• Embedded machine vision by colour capacity, scan type, sensor technology</td>
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<td></td>
<td>• Machine vision camera by colour capacity, scan type, data type, chip type, 2D/3D, light type</td>
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<td>• Frame grabber by colour capacity, data type</td>
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<td>• Machine vision lenses by area/line scan, fixed focus/zoom, telecentric/non-telecentric</td>
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</tbody>
</table>

### Key Issues Addressed
- What is the current state of the global machine vision hardware market?
- What key market trends are affecting the growth of the hardware market?
- How will the market develop through 2025?
- What are the major drivers of market growth and the key challenges faced by the industry?
- What are the bottlenecks in technology development for machine vision hardware?
- What are the key market players and what are their products and services?
- What are the strategic recommendations for market participants?
Machine vision software, services and accessories

KEY ISSUES ADDRESSED

- What is the current state of the global machine vision software market?
- What key market trends are affecting the growth of the software market?
- How will the market develop through 2025?
- What are the major drivers of market growth and the key challenges faced by the industry?
- What are the bottlenecks in technology development for machine vision software?
- What are the key market players and what are their products and services?
- What are the strategic recommendations for market participants?

KEY MARKET FORECASTS

- **Machine vision library software** revenue by industry, region, hardware type: Forecasts 2020-2025
- **Machine vision system software** revenue by industry, region, hardware type: Forecasts 2020-2025
- **Machine vision services and accessories** revenue by industry, region: Forecasts 2020-2025

COVERAGE

- **Industry Segments**
  - Automotive
  - Building automation
  - Chemical
  - Food and beverage
  - Machinery
  - Medical
  - Metals and mining
  - Packaging
  - Pharmaceutical
  - Power
  - Printing
  - Robotics
  - Semiconductors and electronics
  - Transport and traffic
  - Utilities
  - Other industries

- **Software Categories**
  - Machine vision by system software
  - Machine vision by library software
  - Machine vision software by smart sensor
  - Machine vision software by smart camera
  - Machine vision software by machine vision camera
  - Machine vision software by machine vision lenses

KEY ISSUES ADDRESSED

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Machine vision applications

- What is the current state of the global machine vision software market?
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Machine vision applications revenue by industry, region, and hardware type: Forecasts 2020-2025

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  - Machinery
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- Application Categories
  - High speed inspection
  - Multispectral imaging
  - Defect detection
  - Bin picking
  - Camera mobility
  - Collaborative robotics
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  - Miscellaneous vision inspection
  - Others

KEY ISSUES ADDRESSED | KEY MARKET FORECASTS | COVERAGE

Machine vision applications revenue by industry, region, and hardware type: Forecasts 2020-2025

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Machine vision in factory automation– 2021 |
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