



**COGNEX**  
A COMPANY WITH  
**VISION**

# **Cognex - Machine Vision & AI**

Heiko Weber | Field Product Marketing Manager

23-01-2025

# Agenda:

- Cognex Introduction
- What is Machine Vision
- Cognex Global Product Overview
- Machine Vision Technologies
- Cognex Products with AI
- Cognex Industries with Deep Learning Examples
- Deep Learning Validation
- Q&A

# COGNEX

TRUSTED BY  
**>25K**  
CUSTOMERS

**OVER 40**  
YEARS IN BUSINESS

**\$1B**  
2022 REVENUE

GLOBAL OFFICES IN  
**20+** COUNTRIES

**400+**  
CHANNEL PARTNERS

**4,000,000+**  
SYSTEMS SHIPPED

A photograph of three people in a laboratory or office setting. A man in a light blue shirt is on the left, a woman in a white lab coat with 'COGNEX' on it is in the center, and a man with glasses in a purple sweater is on the right. They are all looking intently at a piece of equipment in the foreground. The background shows computer monitors and other lab equipment.

# TECHNOLOGY LEADERSHIP

**16%** OF REVENUE INTO  
**R&D**

**>1K** US & INTERNATIONAL PATENTS  
ISSUED & PENDING

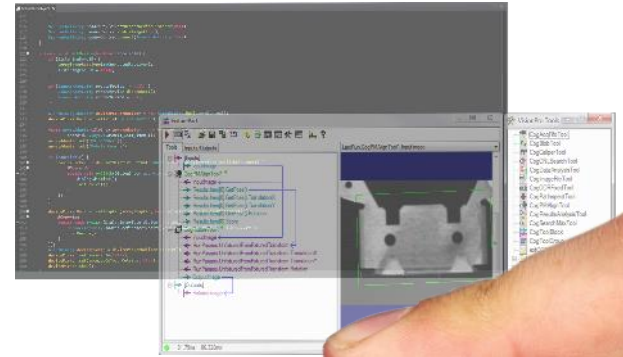
# WHAT IS MACHINE VISION?

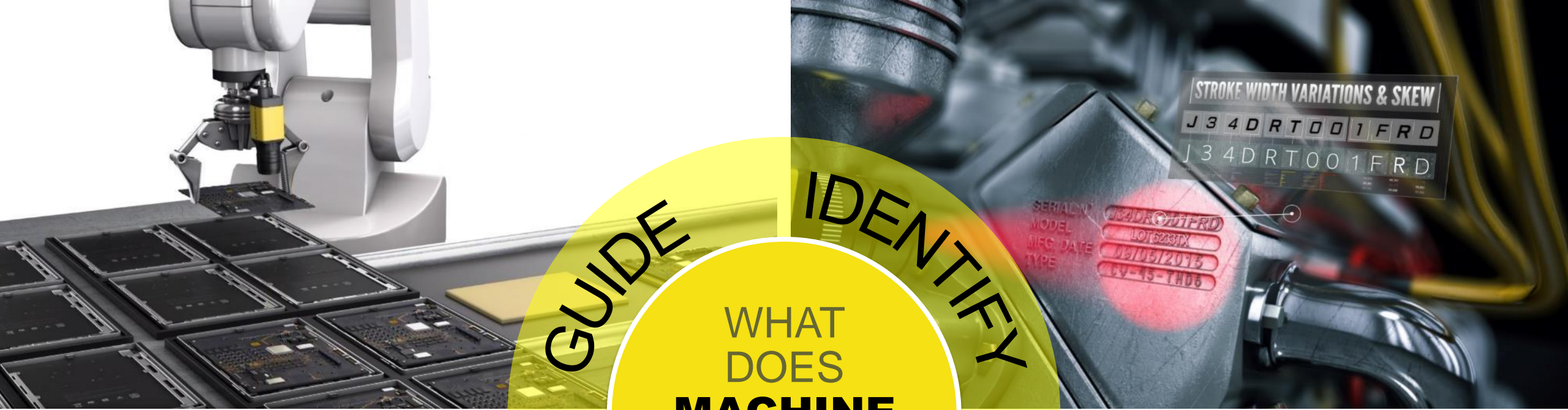
Brain

Eyes

Optics

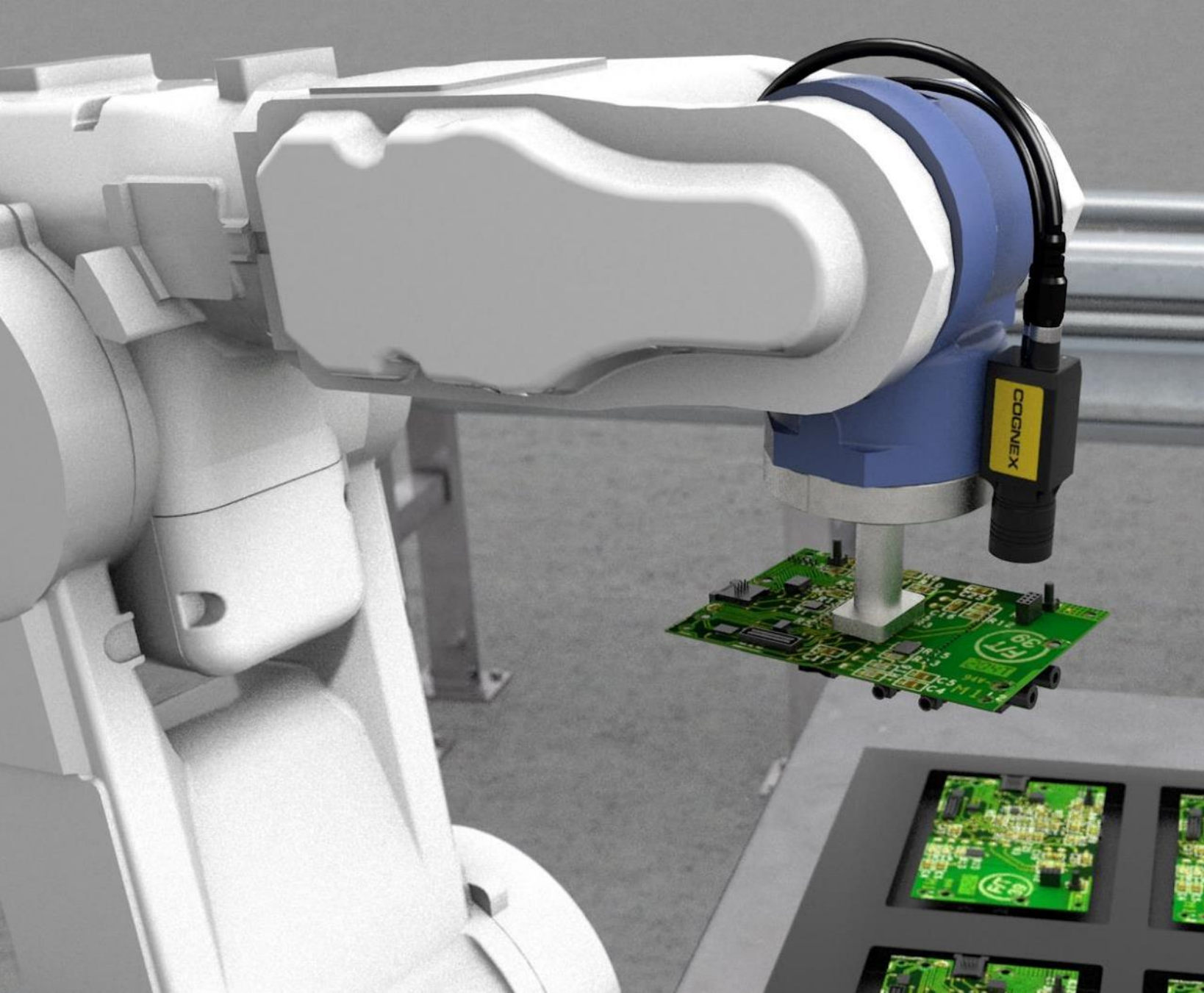
Vision software  
& algorithms





GUIDE  
IDENTIFY  
INSPECT  
GAUGE

WHAT  
DOES  
**MACHINE  
VISION**  
DO?



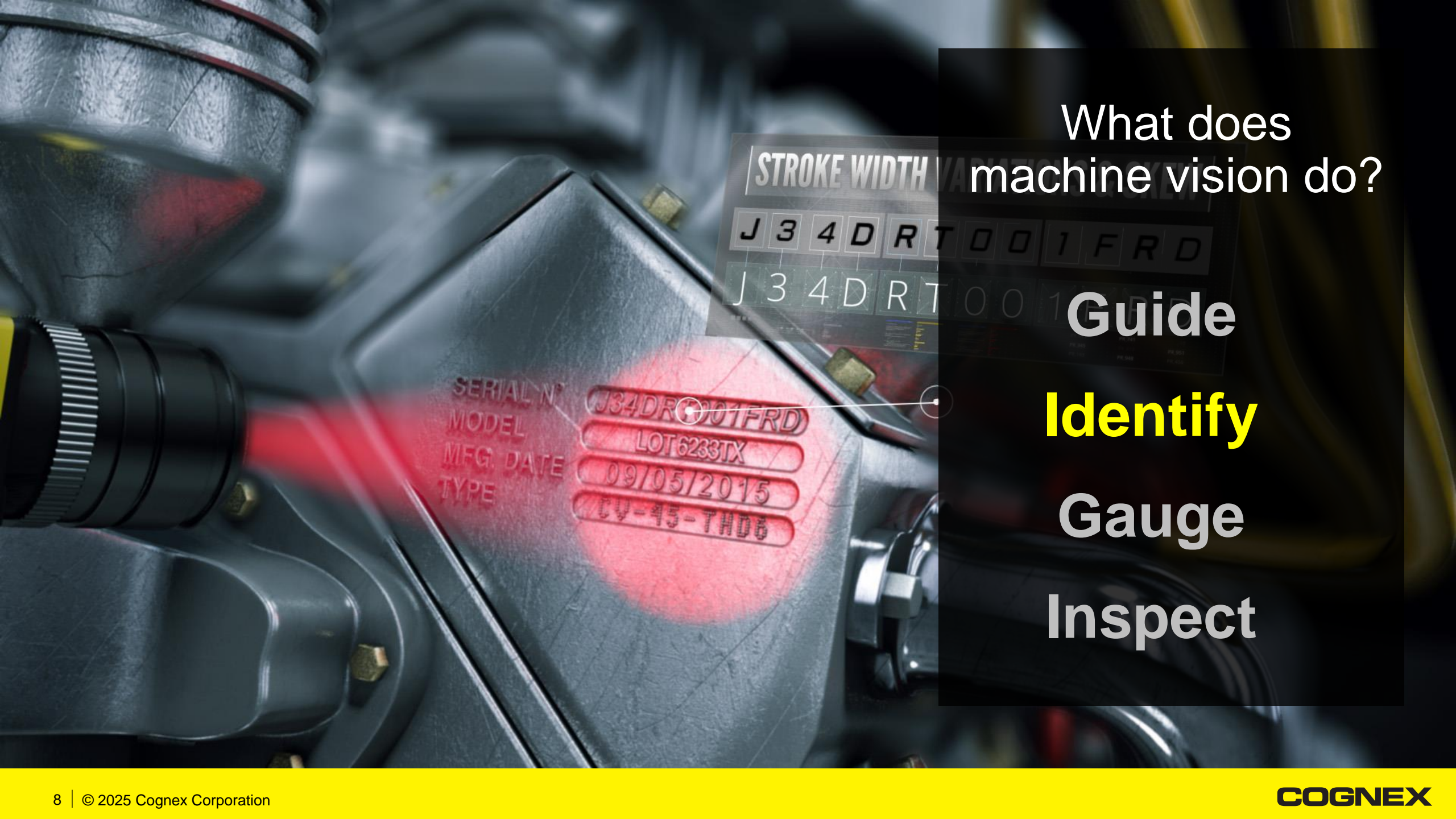
What does  
machine vision do?

**Guide**

**Identify**

**Gauge**

**Inspect**



What does machine vision do?

**Guide**

**Identify**

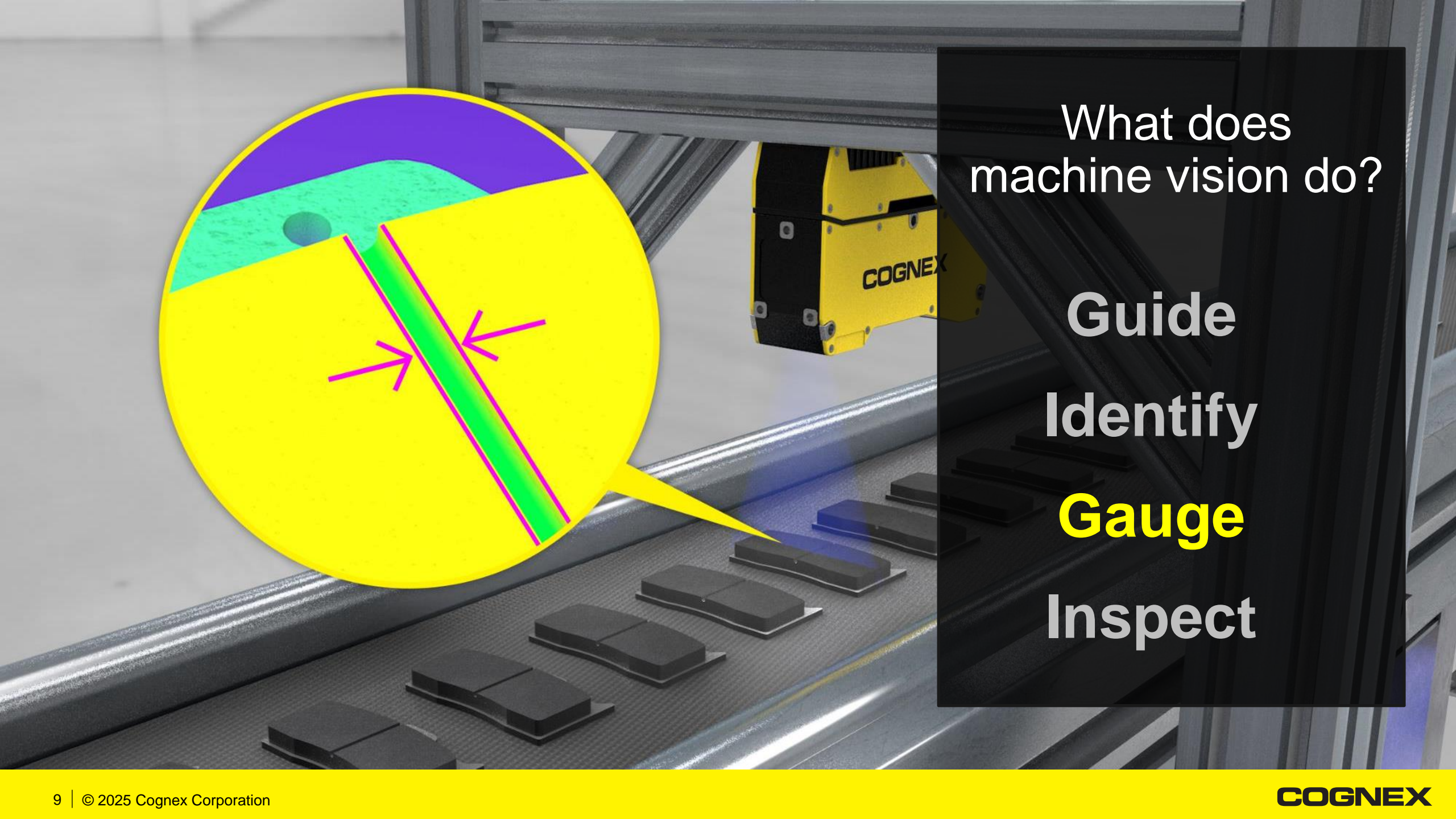
**Gauge**

**Inspect**

STROKE WIDTH

J	3	4	D	R	T	0	0	1	F	R	D
J	3	4	D	R	T	0	0	1	F	R	D

SERIAL N° J34DR001FRD  
 MODEL LOT6233TX  
 MFG. DATE 09/05/2015  
 TYPE CV-45-THD6



What does  
machine vision do?

**Guide**

**Identify**

**Gauge**

**Inspect**



What does  
machine vision do?

- Guide
- Identify
- Gauge
- Inspect**

# Cognex portfolio

## 2D vision

Improve quality control across your operations with easy-to-use automation



## 3D vision

High accuracy surface feature measurements for precise 3D inspections



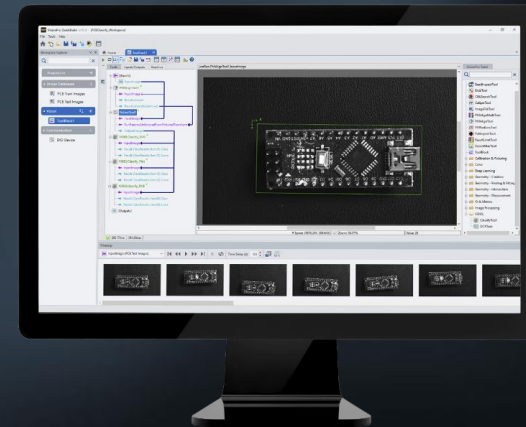
## Barcode readers

Industry-leading 1D and 2D code reading performance



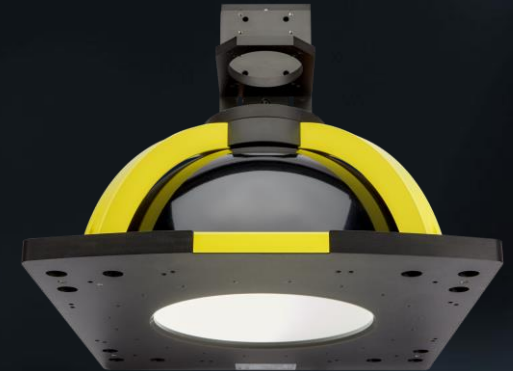
## Vision software

Power and flexibility to solve challenging applications



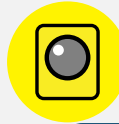
## Vision accessories

High-performance lenses and best-in-class computational image formation lighting



# MACHINE VISION TECHNOLOGIES

# Machine vision technologies



## Rule-based vision

*Roots of  
Machine Vision*



Measurement and gauging



Location and fixturing



Robotic guidance



## Deep learning

*Designed for  
complex applications*



Complex defect detection



Tasks with significant variation



Highly customized jobs



## Edge learning

*Designed for  
ease of use*



Classification



Assembly verification



Character reading

# How does Cognex Deep/Edge Learning Work?

**1** Collect images of objects

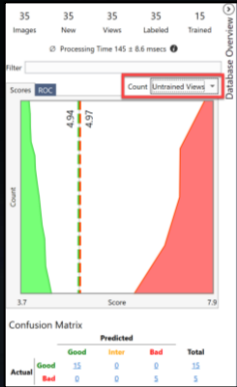


**2** Label features on images



**3** Train the model

**4** Validate performance on untrained images



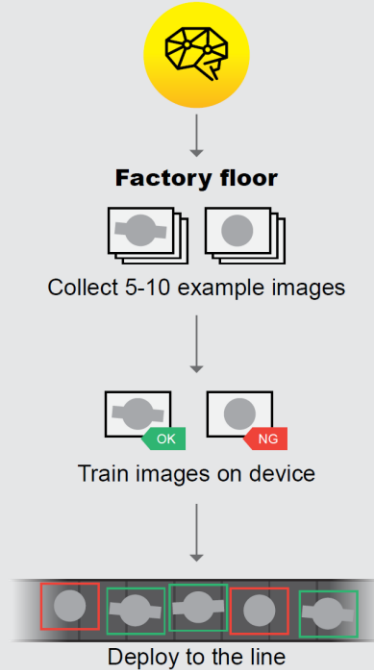
# How to deploy



## Edge Learning

Edge learning neural networks come pre-trained and ready to deploy on the line.

### Pre-loaded training and optimization



Total time:  
**Minutes**



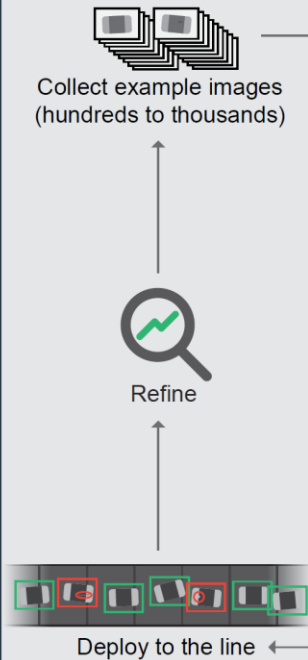
Technical expertise:  
**No prior experience needed**



## Deep Learning

Deep learning neural networks are trained by an experienced professional on a PC.

### Factory floor

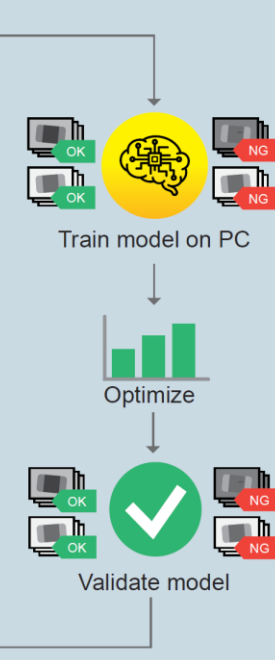


Total time:  
**Hours to days**



Technical expertise:  
**Significant training in AI and programming**

### Engineering/vision lab



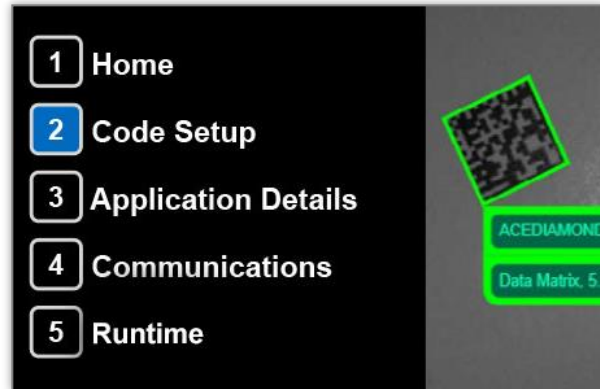
# COGNEX PRODUCTS WITH AI



# In-Sight DataMan 290 Series

## All-purpose Code Reader

Read any code, in any condition



Web UI with guided Setup



Fully integrated All-in-one light



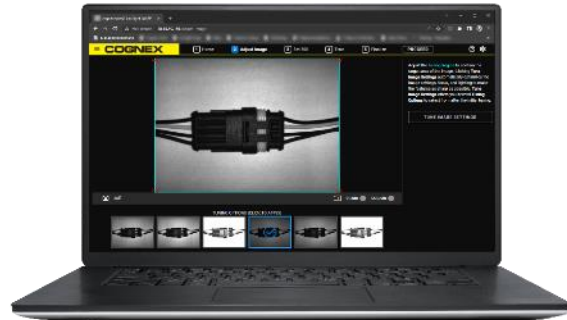
AI-enhanced tuning and decoding

# In-Sight SnAPP Series



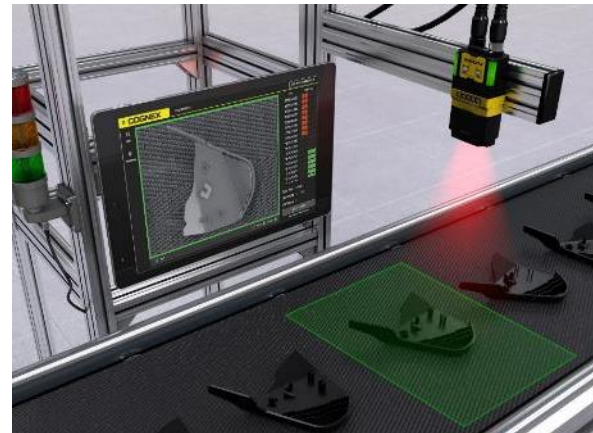
## Sensors, Reimagined

One device, endless possibilities



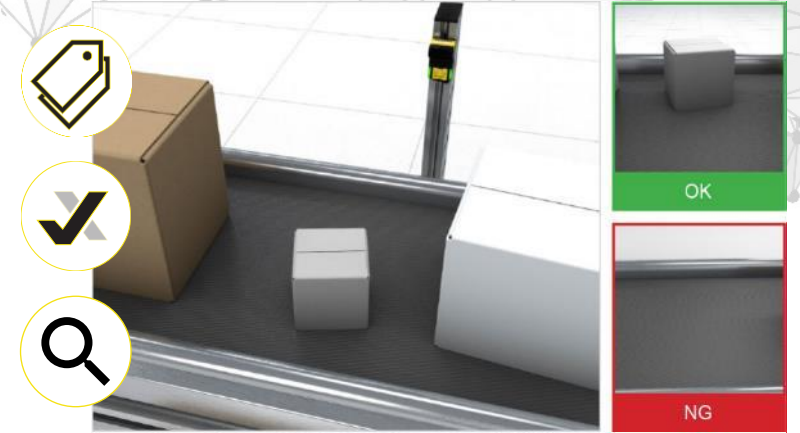
### High ease of use

Automate in minutes with intuitive setup, no experience needed



### Superior detection

Achieve higher detection rates with image-based analysis and embedded AI



### Flexible functionality

Solve a wide range of error-proofing tasks

# In-Sight 2800 Series

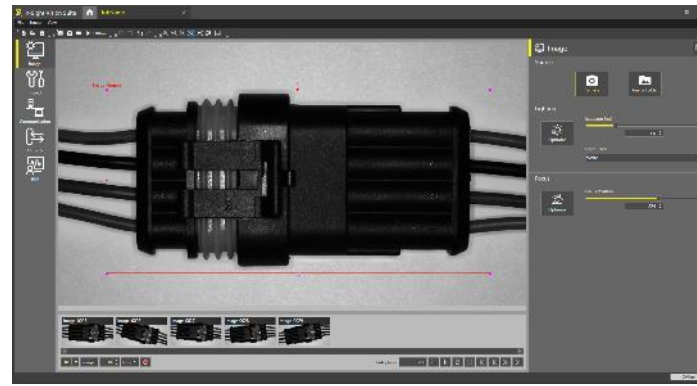


## The power of AI without the complexity

- Easy-to-use vision system for error detection
- Optimize product quality with powerful edge learning and rule-based vision tools



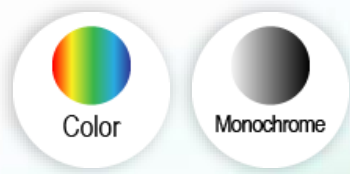
Solves **presence/absence detection**, as well as **sortation** and **character reading** applications



Deploy tasks in **minutes** with intuitive, point-and-click training

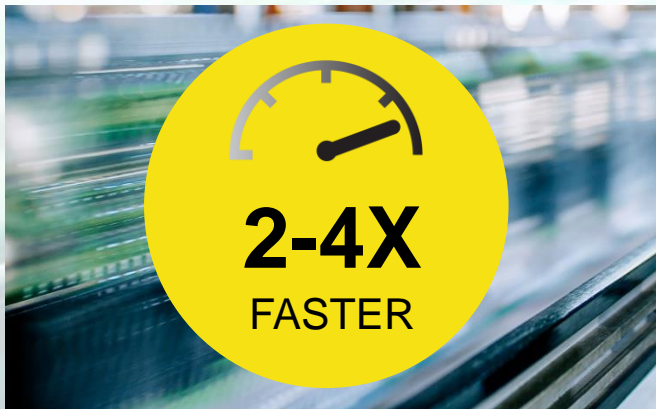
Automate a range of applications with **modular hardware**

# In-Sight 3800 Series

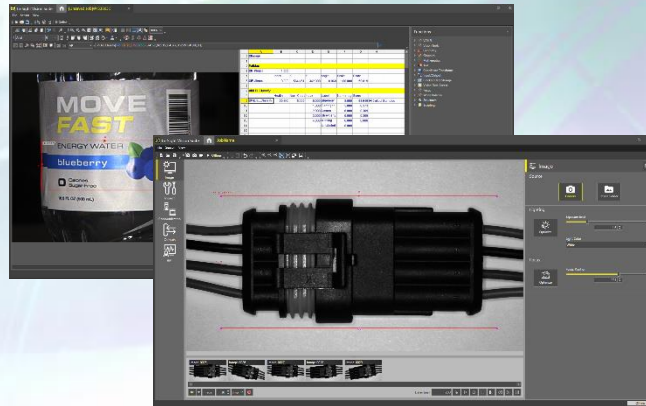


## Automate, faster

All-in-one vision system delivers high speed, high flexibility, and high resolution



Run more inspections in less time with 2-4X faster tool speeds\*



Seamlessly scale your solution with a common software platform



Improve the accuracy of your results with advanced imaging

\*Compared to previous generation systems

# In-Sight D900



Powered by AI to solve complex inline inspections

Suite of AI tools solves a wide range of applications



Flexible Image Technology™ optimizes image formation and reduces reliance on external lighting

Field-changeable C-mount, S-mount and autofocus lenses for best image resolution based on working distance

Multi-core processor and deep learning image co-processor optimized for high-speed deployment without a PC

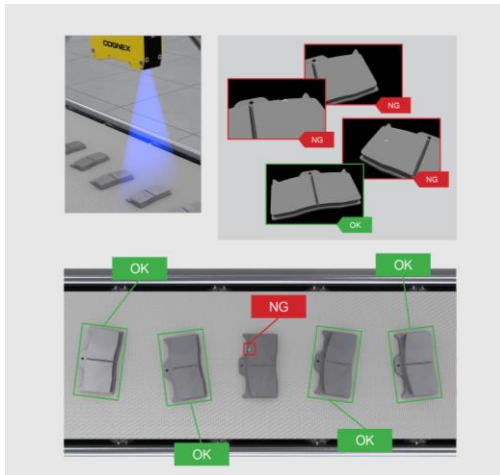
Onboard SD card for additional data storage



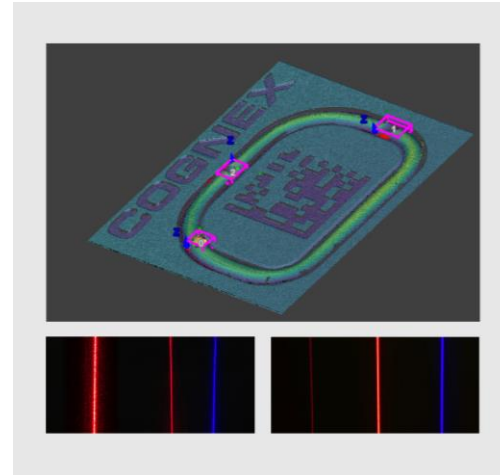
IP67-rated housing

# In-Sight L38 Series

- **World's first 3D vision system powered by AI**
- AI-powered 3D inspection system delivers fast deployment, high ease of use, and reliable results



Optimize efficiency with example-based training, point-and-click setup, and pre-trained AI



Improve reliability and throughput with embedded AI, powerful 3D tools, and advanced optics



Efficiently scale your automation with a unified software platform

# VisionPro

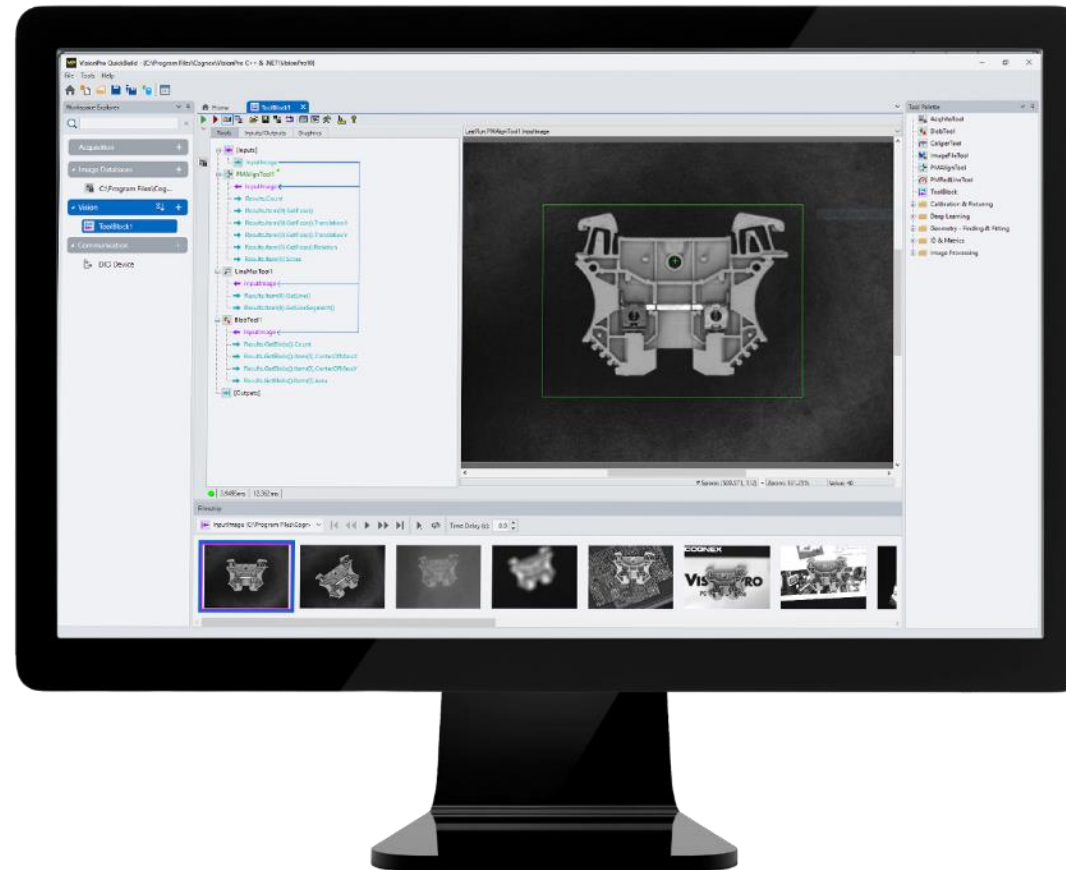
## The industry's leading PC-based vision software for challenging, high-speed 2D and 3D vision applications

Setup and deploy vision applications—no matter the camera type, resolution, or PC hardware

Reliable vision tools for guidance, inspection, gauging and identification applications

Integration of rule-based vision, hybrid smart tools, and AI technology in common environment

Access to breakthrough deep learning-based image analysis for complex inspection, part location, classification, and OCR



QuickBuild fast prototyping environment combines the power and flexibility of advanced programming with ease of development

Fully integrated with an extensive .NET class library and user controls

Future-proofed design addresses evolving trends and supports latest technical requirements

# COGNEX INDUSTRIES AND EXAMPLES

# AUTOMOTIVE



## Auto Body Assembly

Gap and Flush Inspection, Body Panel De-racking and Inspection, Steering Knuckle Inspection, Wheel and Lug Nut Torquing, Kitting Process Systems



## Powertrain

Transmission Control Module, Transmission Assembly, Torque Converters and Engine Valves, RTV Glue Bead Seal Inspection

## Electronics Inspection

Electrical Component Inspection, Printed Circuit Board Inspection, Electrical Module Seal Inspection, Electrical Switch Assembly Inspection, Battery Systems



## Brake and Safety Systems

Brake Assembly Traceability, Brake Pad Manufacturing Inspection, Automated Brake Valve Inspection, Air Bag Component and Canister Inspection, Seatbelt Component Inspection



## Tire Inspection and Sorting

Tire and Wheel Identification, Automated Sorting and Handling, Tire and Wheel Assembly, Assembly Inspection Systems

# Air Filter Defect Detection



Automotive



No Fixture



5 MP

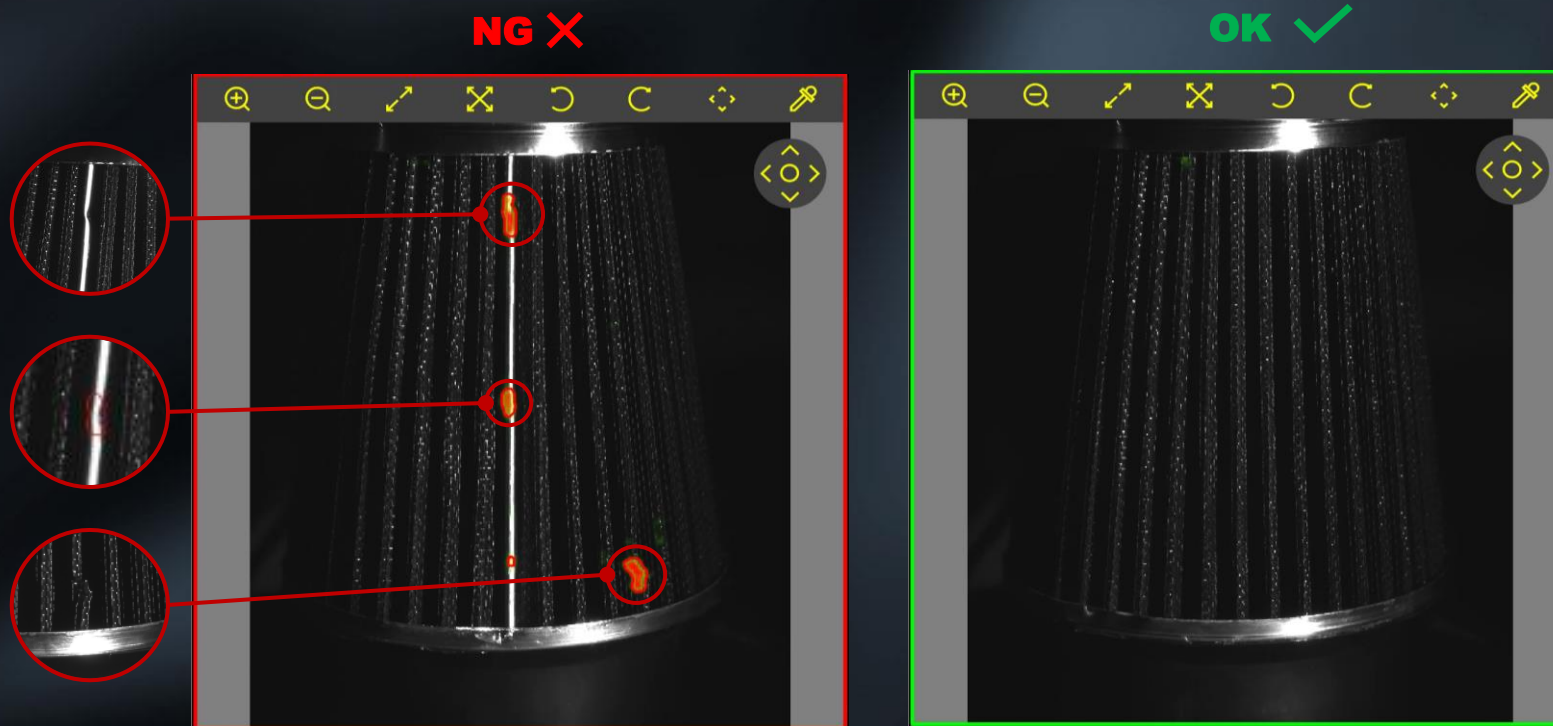


Monochrome

**Challenges:** Defects must be detected on a complex textured background. Expected variations in lighting make using traditional rules-based machine vision impossible.

**Solution:** ViDi Detect trained on a reference set of a hundred good images accurately detects anomalies on the textured area while being tolerant to natural part variations.

**Related Applications:** Metal braided parts, Speaker mesh



# Ring Terminal OCR

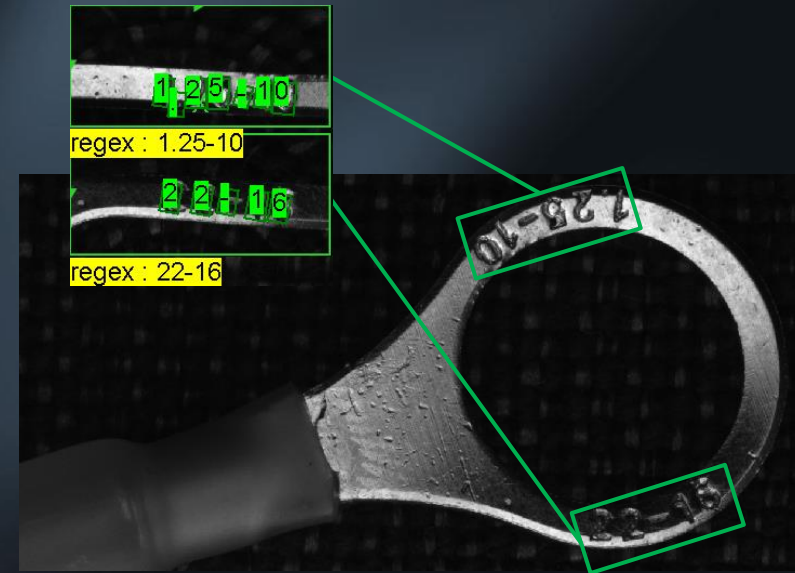
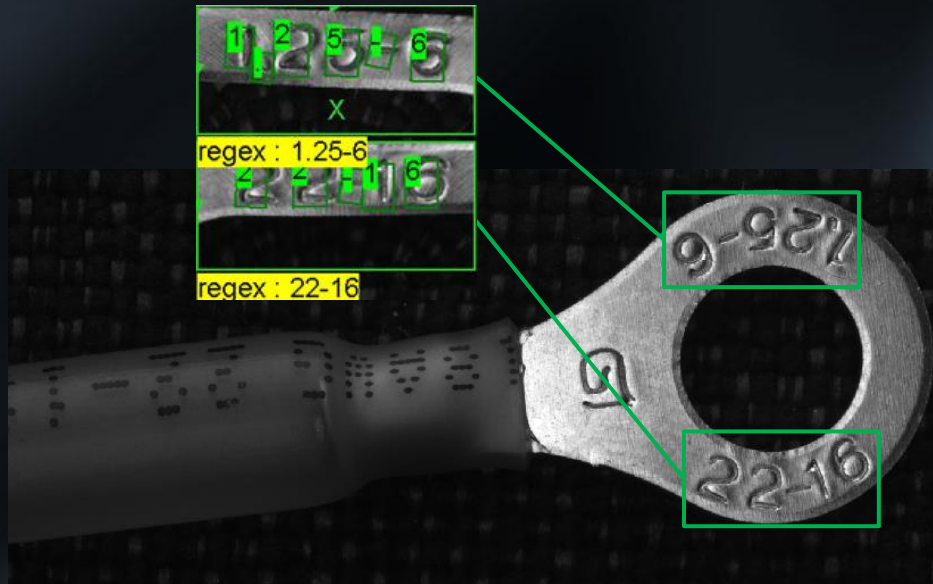


Automotive PatMax Fixture 5 MP Monochrome

**Challenges:** Stamped metal at various angles of reflection creates a challenge for rules-based vision. No two features look exactly alike, especially on curved surfaces.

**Solution:** ViDi Read can accurately read letters at a wide range of lighting conditions, and In-Sight has the toolset to optimize the image being fed into the neural network.

**Related Applications:** Curved bottle date/lot codes, metal parts



# Motor Block Parts



Automotive



PatMax Fixture



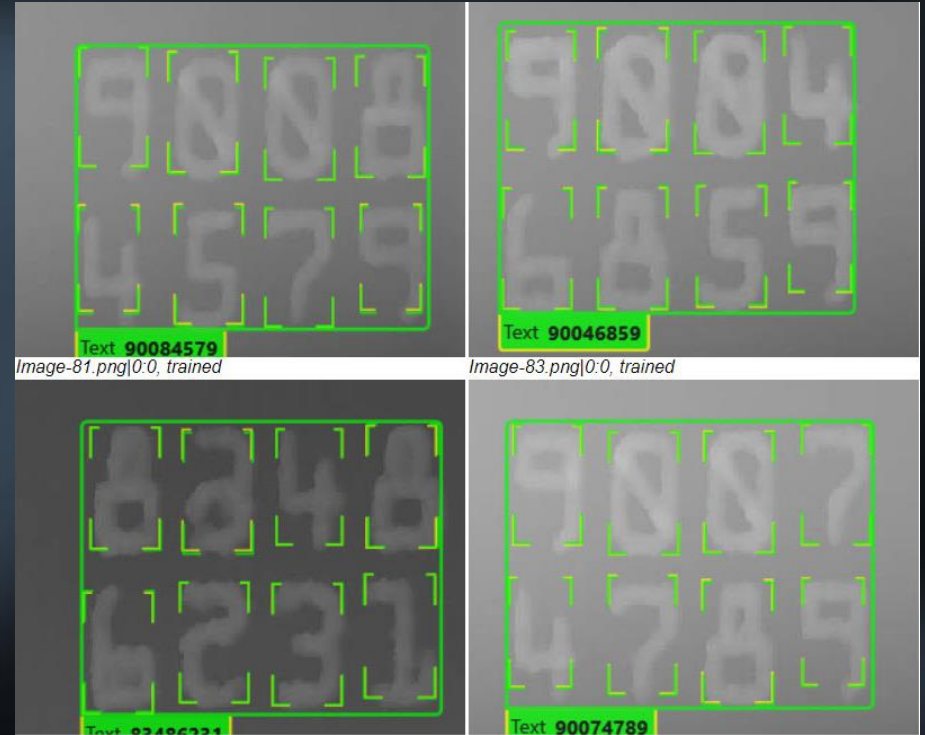
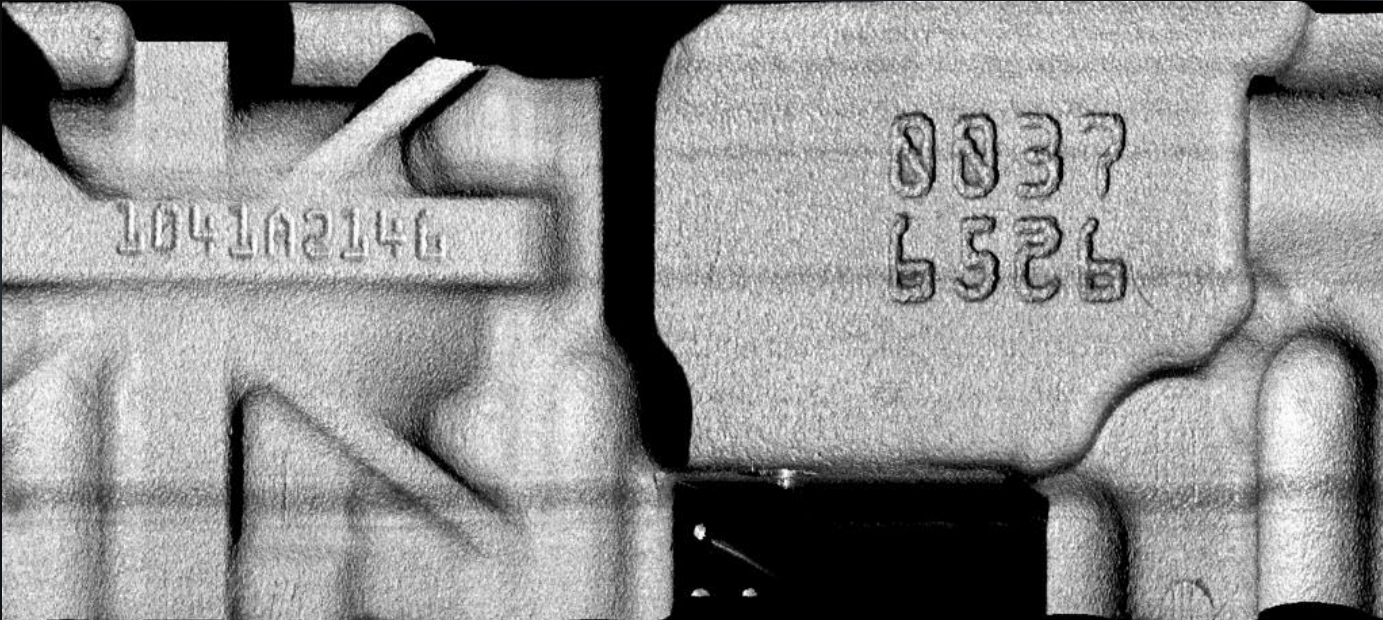
5 MP



Monochrome

**Challenges:** Stamped cast Iron creates a challenge for rules-based vision. No two features look exactly alike, difficult to illuminate properly.

**Solution:** ViDi Read can accurately read letters at a wide range of lighting conditions, and In-Sight has the toolset to optimize the image being fed into the neural network.



# OCR divers



Automotive



PatMax Fixture



5 MP



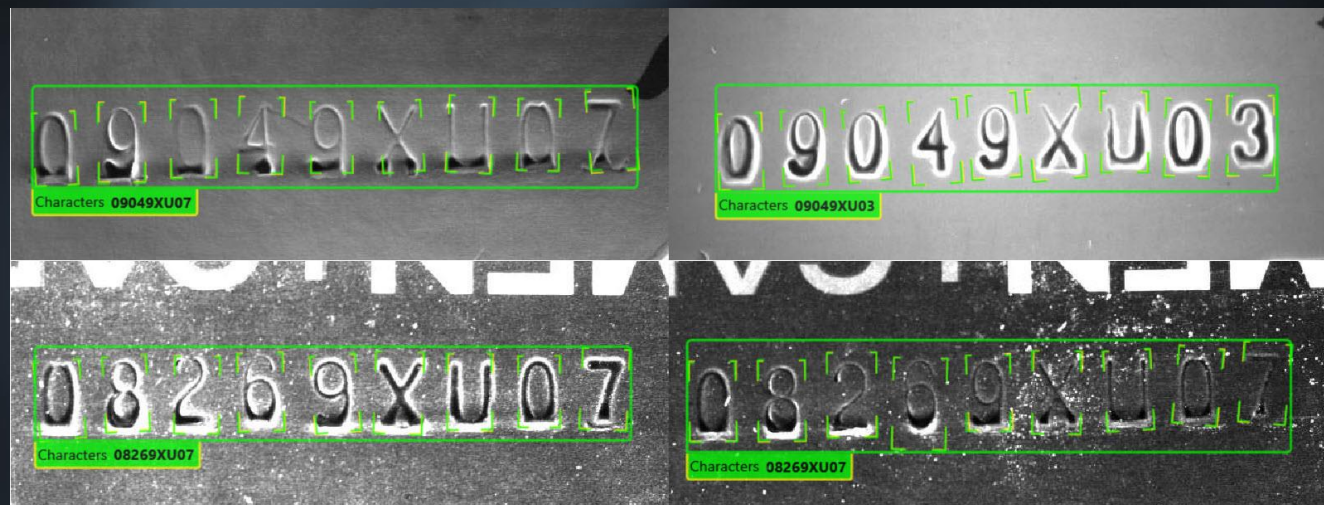
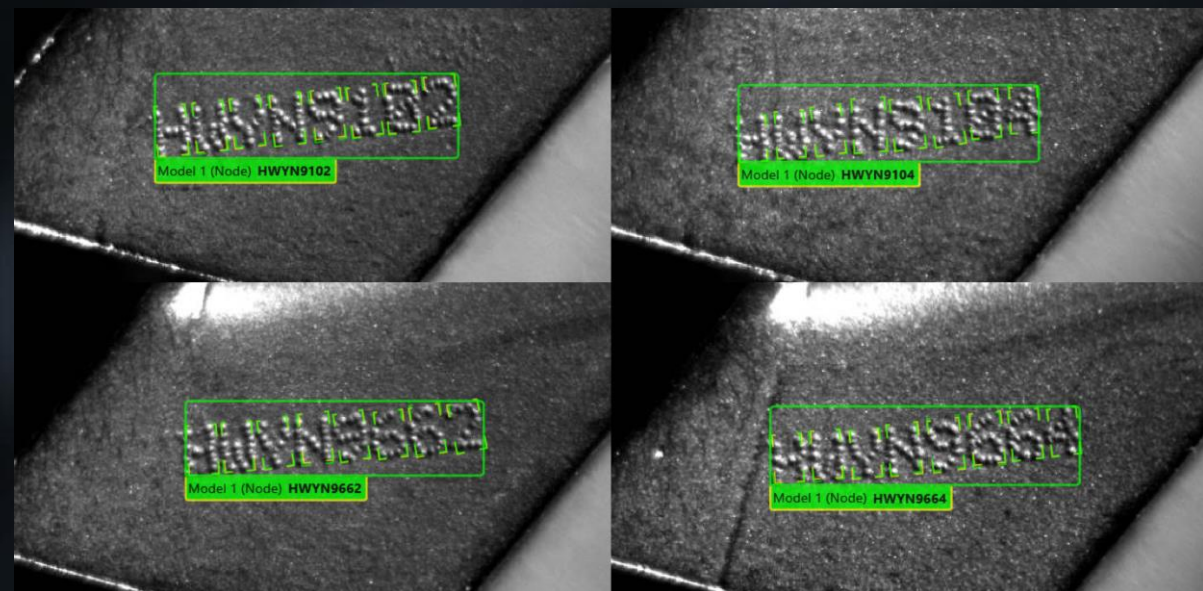
Monochrome

**Challenges:** Dotted font on metal creates a challenge for rules-based vision. No two features look exactly alike, especially on curved surfaces.

**Solution:** ViDi Read can accurately read letters at a wide range of lighting conditions, and In-Sight has the toolset to optimize the image being fed into the neural network.

**Challenges:** Elevated font on metal creates a challenge for rules-based vision. No two features look exactly alike, especially on curved surfaces.

**Solution:** ViDi Read can accurately read letters at a wide range of lighting conditions, and In-Sight has the toolset to optimize the image being fed into the neural network.



# Car Plug



Automotive



PatMax Fixture



5 MP

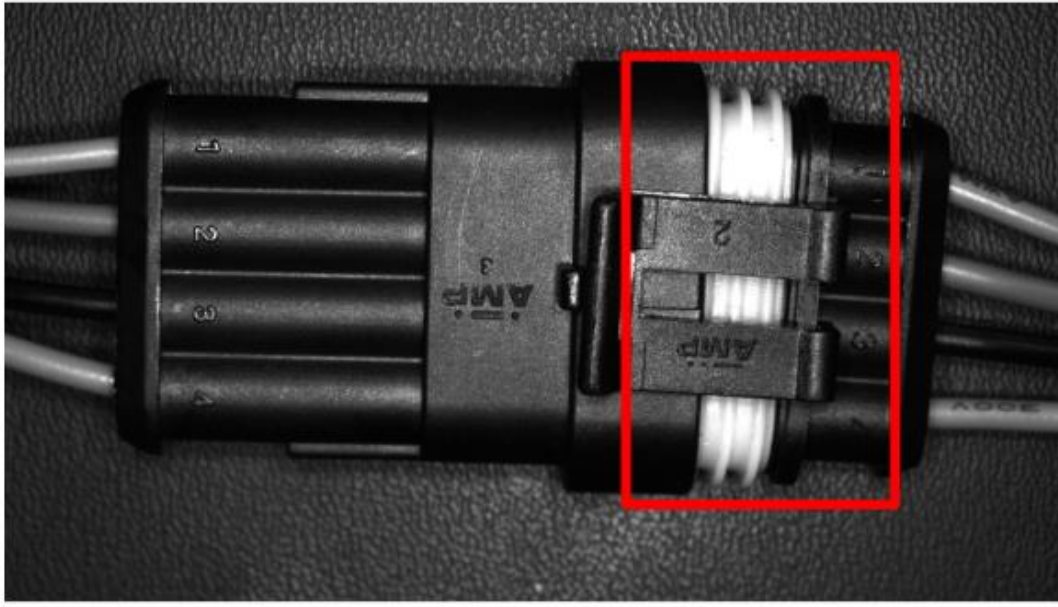


Monochrome

**Challenges:** Stamped metal creates a challenge for rules-based vision. No two features look exactly alike, especially on curved surfaces.

**Solution:** ViDi Classify can accurately detect even small variations, and In-Sight has the toolset to optimize the image being fed into the neural network.

NG X



OK ✓



# Assembly Inspection



Automotive



PatMax Fixture



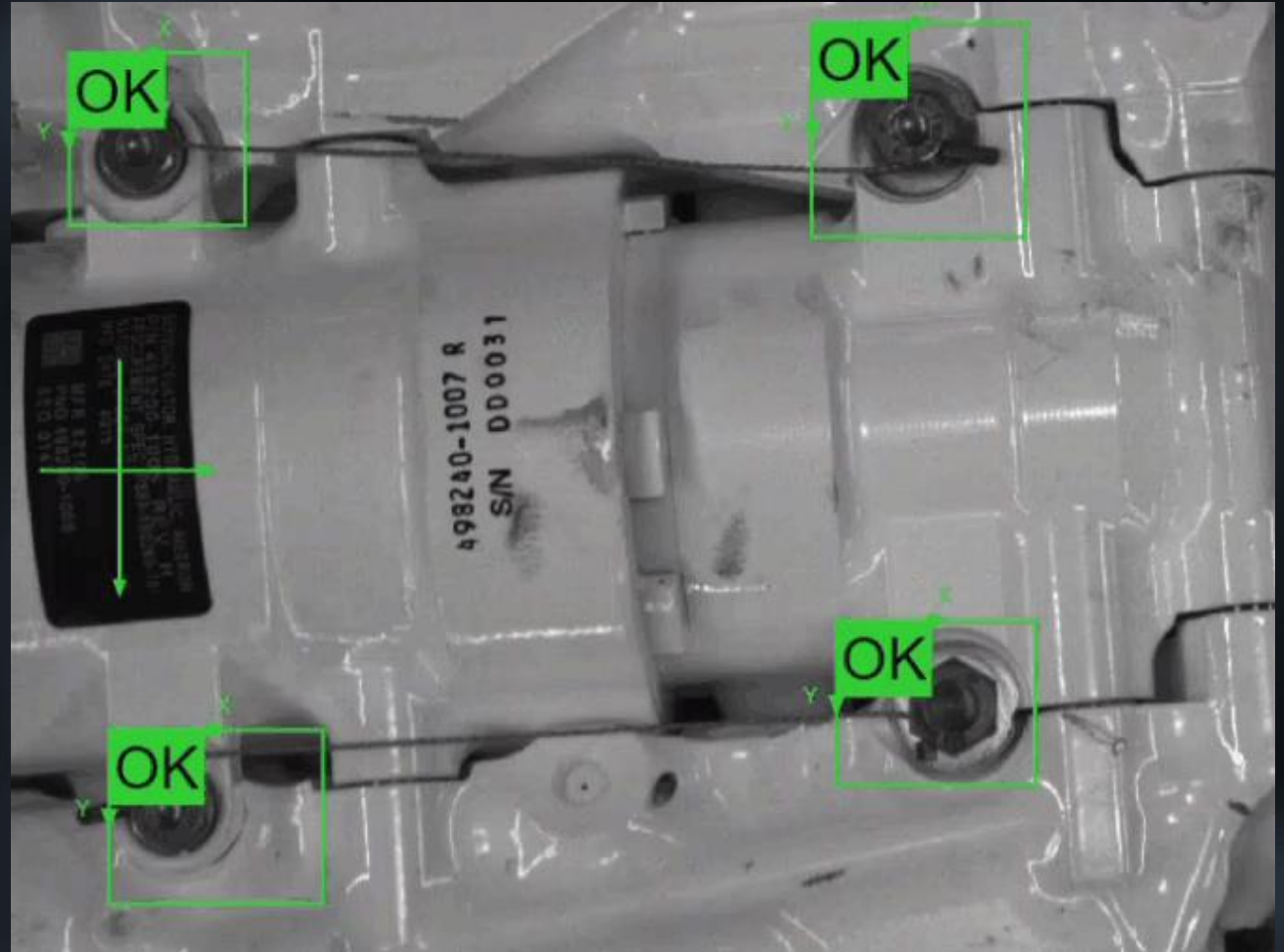
5 MP



Monochrome

**Challenges:** Inspecting for presence and orientation of screws on varying conditions.

**Solution:** ViDi Classify can reliably distinguish between good and bad, and In-Sight has the toolset to optimize the image being fed into the neural network.



# Assembly Inspection



Automotive



PatMax Fixture



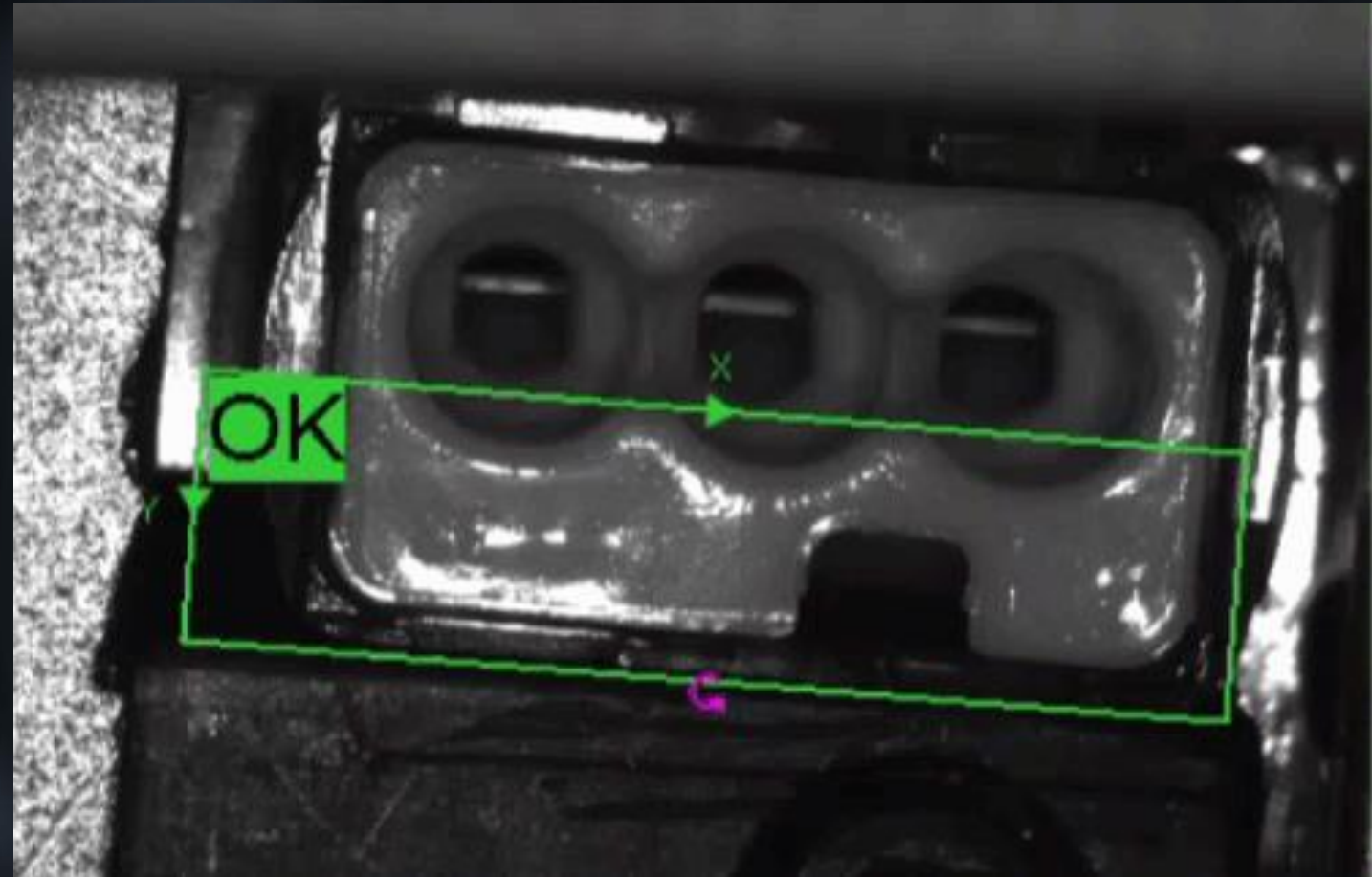
5 MP



Monochrome

**Challenges:** Inspecting for presence and proper insulation.

**Solution:** ViDi Classify can reliably identify missing or damaged insulation, and In-Sight has the toolset to optimize the image being fed into the neural network.



# LOGISTICS



## Retail Distribution

Automated sorting, pallet scanning, pick and pack sorting, print and apply, warehousing



## Logistics & Transportation

Courier and parcel package sorting and delivery, field service, airport baggage handling

## Ecommerce Fulfillment

Inbound sorting, pick and pack sorting, print and apply, warehousing, outbound sorting





# 5- or 6-Sided Modular Vision Tunnel


High-speed multi-sided barcode reading tunnel for high volume applications where manual handling is minimized


Limited egress interference with slim solution design

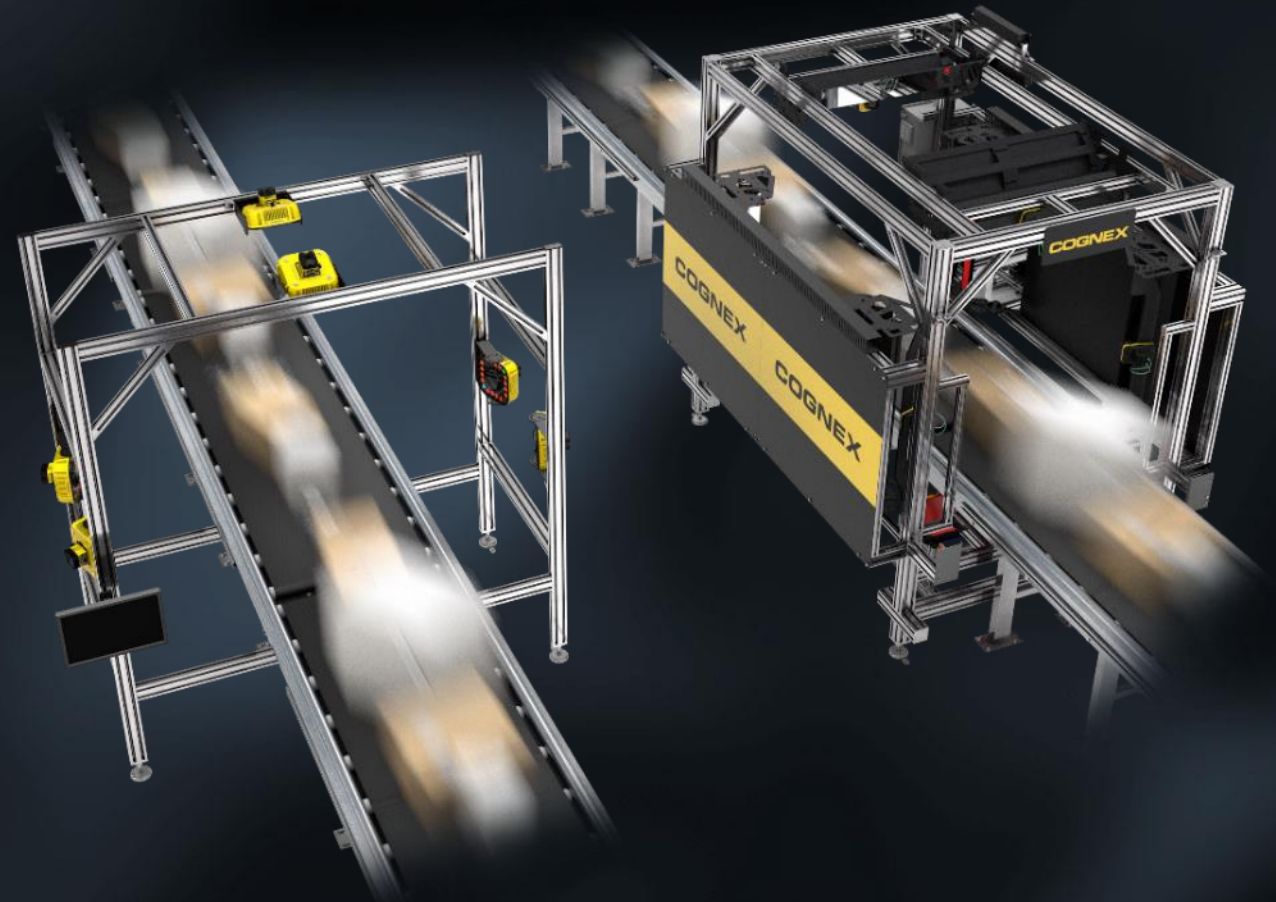
Highest throughput with extreme perspective decoding, small gap handling, and barcode assignment

 Edge Intelligence Configuration, Calibration, and Verification tools

 Multi-reader sync for tunnel integration and synchronization

 HDR and HDR+ technology

 Performance feedback provides rich data for analytics and operational insights



# FOOD & BEVERAGE

## Packaging Inspection

Check for Torn or Missing Labels, Verify Date Code Presence, Detect Damaged Products, Ensure Label Print Integrity, Verify Safety Seal Presence



## Assembly Verification

Detect Missing Items, Check Fill Level, Enhance Palletizing, Guide Robotic Picking and Placement



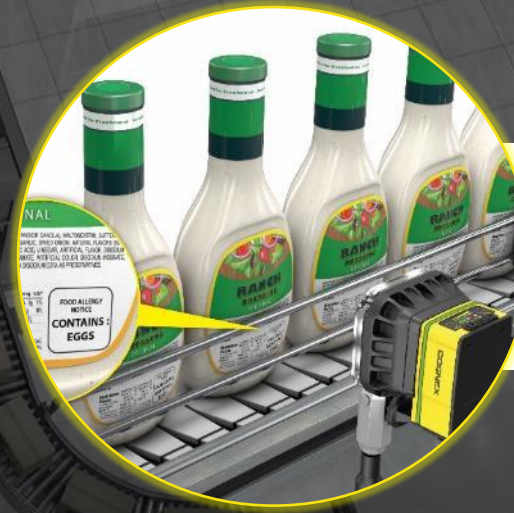
## Product Quality

Check for Debris, Verify Shape/size, Check Completeness, Ensure Consistent Product Color



## Allergen Management

Achieve Traceability, Verify Product Match, Check Correct Allergen Label



# Chocolate Box Assembly Verification



Food/Bev



FindLine Fixture



5 MP

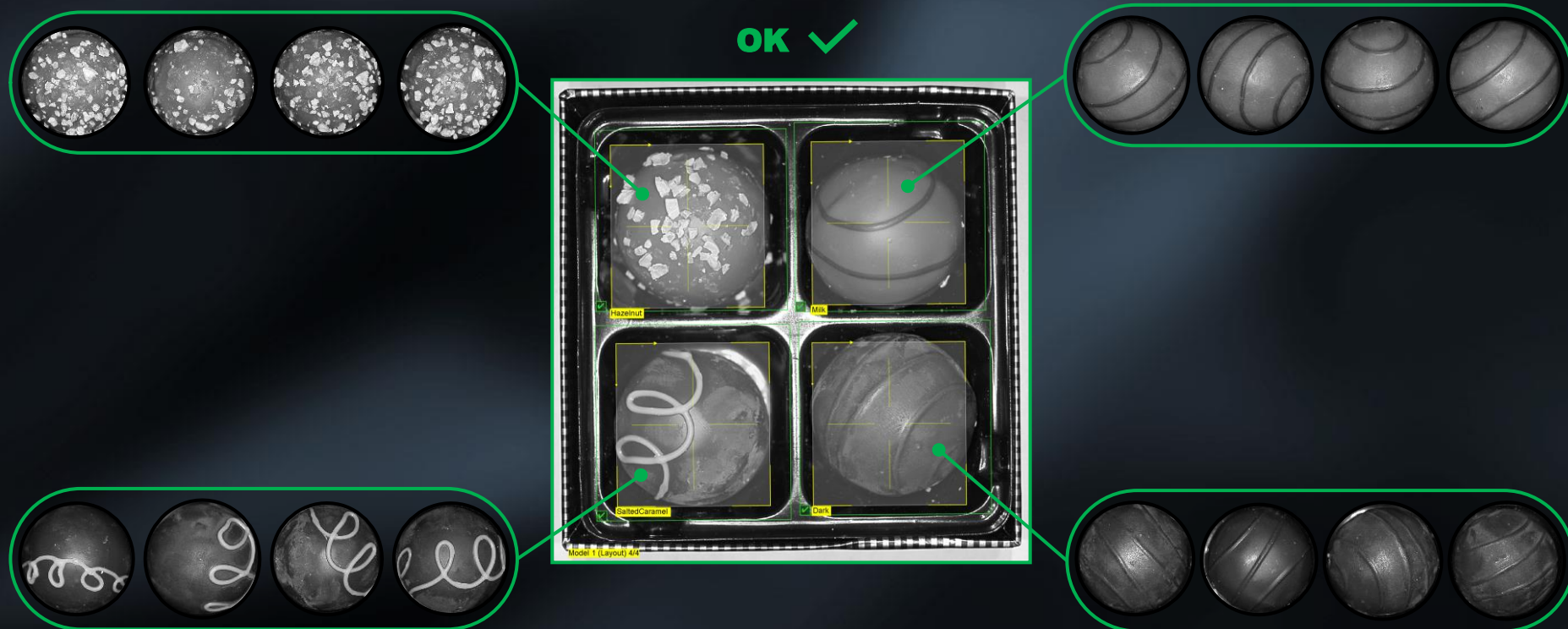


Monochrome

**Challenges:** Each chocolate is difficult to fully describe with rules-based vision because no two chocolates are identical. The natural variation across the same part can be massive.

**Solution:** ViDi Check develops a robust model for each chocolate that can recognize which feature has been placed in each region of the chocolate box and verify assembly.

**Related Applications:** Manually molded parts, food manufacturing



# Meat Sorting



Food/Bev

FindLine Fixture

5 MP

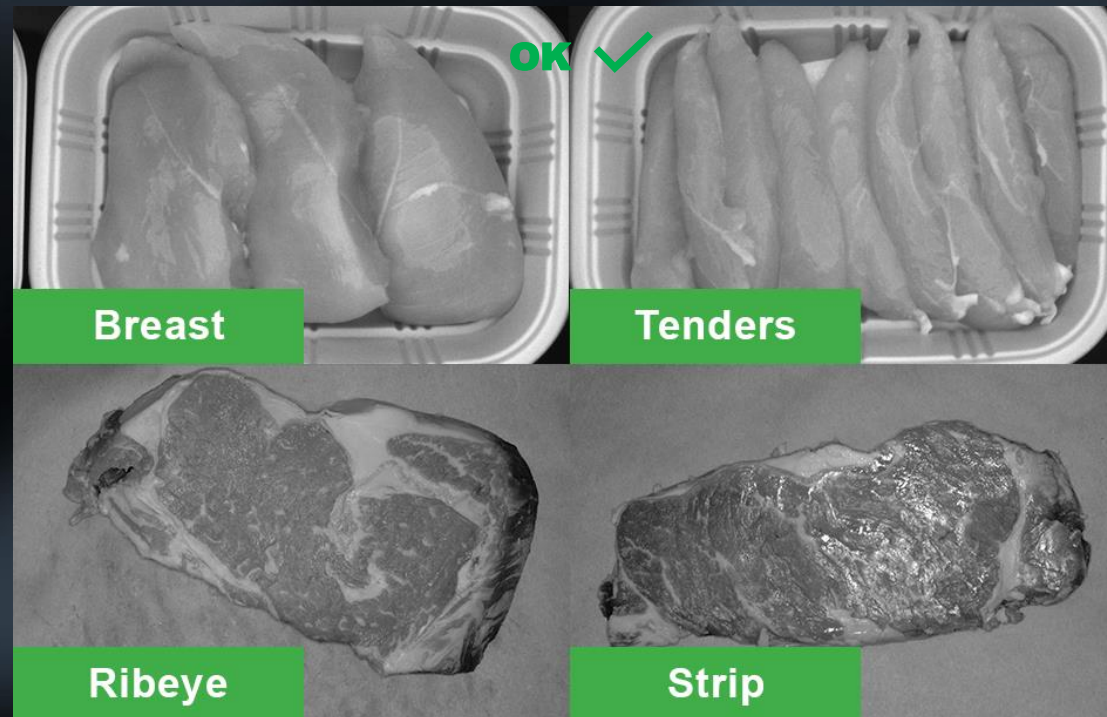


Monochrome

**Challenges:** Natural Products come with variations which are hard to handle with traditional tools.

**Solution:** ViDi Check develops a robust model for each type of meat and identifies what is in the box.

**Related Applications:** Manual inspection, food manufacturing



# Drink Bottle OCR



Food/Bev



PatMax Fixture



5 MP

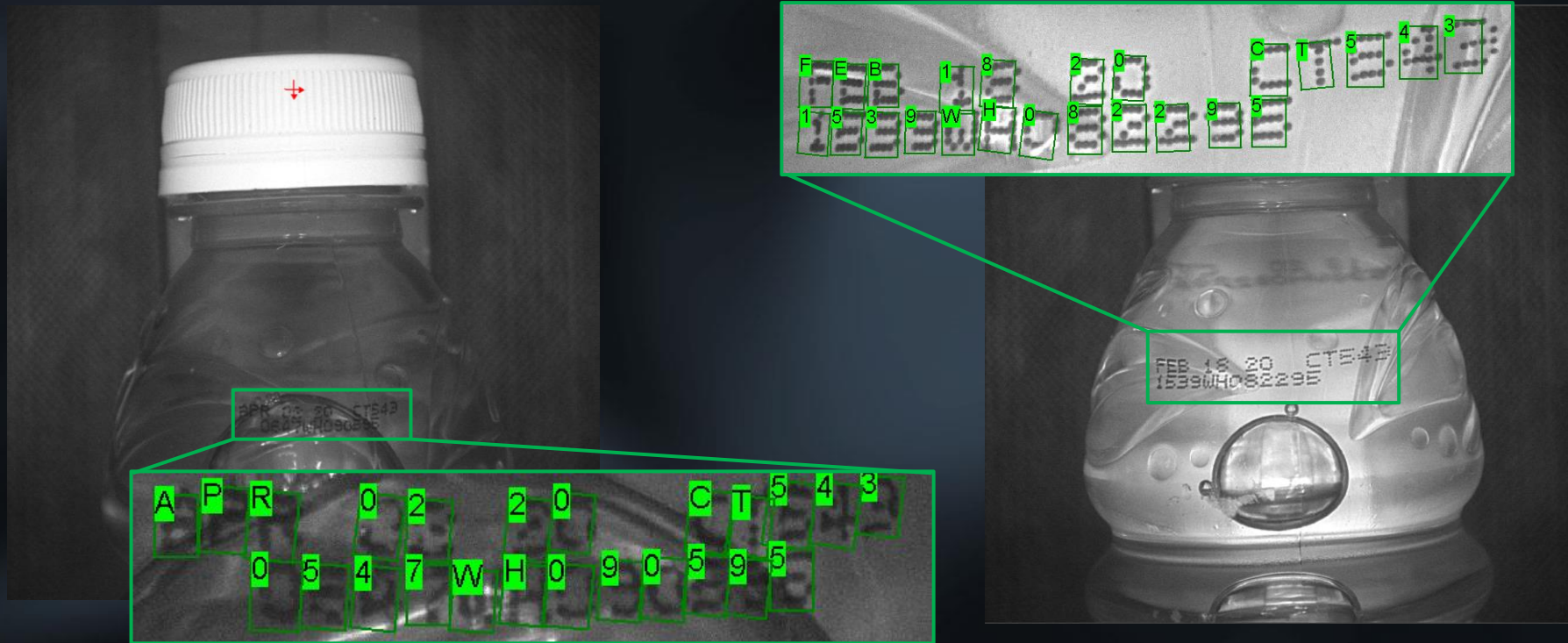


Monochrome

**Challenges:** Varying opacity and bubbles in the liquid create a very inconsistent backgrounds for the printed date and lot codes.

**Solution:** With a robust training set, ViDi Read can accurately read letters in a wide range of lighting and background conditions.

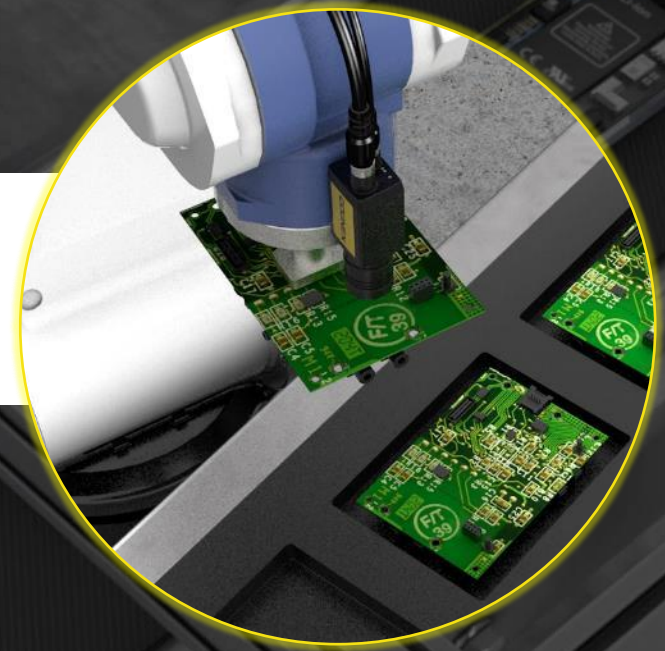
**Related Applications:** Glass bottles, transparent food packaging



# CONSUMER ELECTRONICS

## Device Assembly Systems

Pre-Assembly Interference and Component Check, Print Reading and Verification, Final Assembly, Post-assembly Verification, Robot Alignment and Insertion Guidance



## Final Assembly

Barcode Reading, Material Handling Robot Guidance



## Touch Panel Assembly

Cover Glass to Housing Assembly, Touch Panel Alignment, Lamination and Bonding



# Phone Bottom Check



Electronics



PatMax Fixture



5 MP



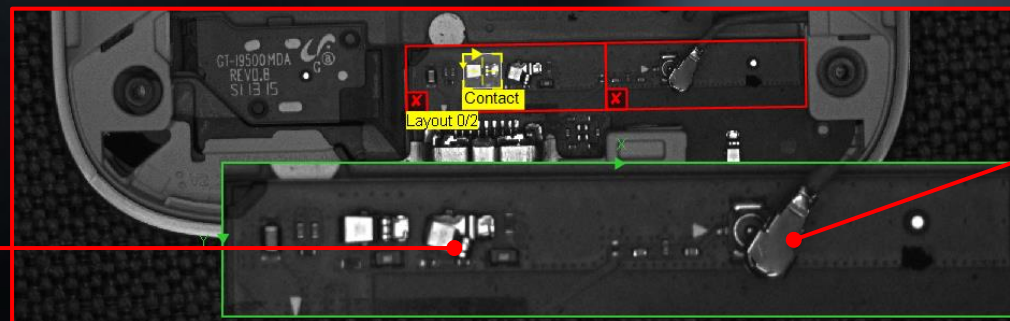
Monochrome

**Challenges:** Bent contacts and unseated connectors are difficult to describe under rules-based vision. The metallic surfaces also provide high lighting variations.

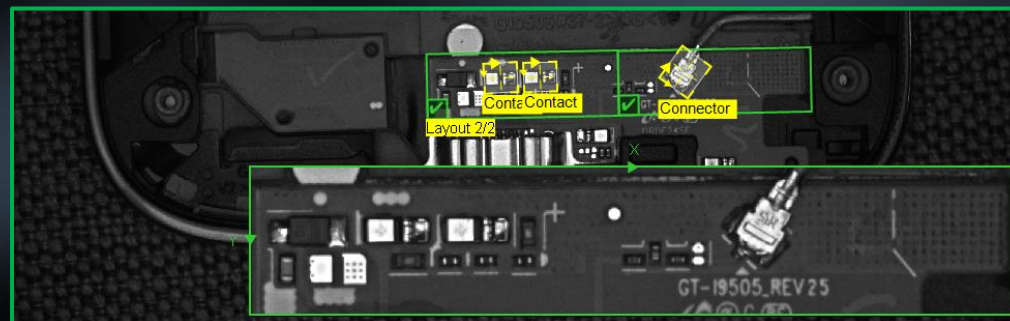
**Solution:** ViDi Check correctly identifies unbent contacts and seated connectors, while not accepting failed assemblies.

**Related Applications:** Mouse PCB

Bent contact



Recognize improper seating of connector



# Phone Bottom Check



Electronics PatMax Fixture 5 MP Monochrome

Image Settings Phone Check Trigger Once Pause Online

OK

Check Features

- Connector
- Contact

Show Graphics

2/2

# Mouse PCB Inspection



Electronics



PatMax Fixture



5 MP

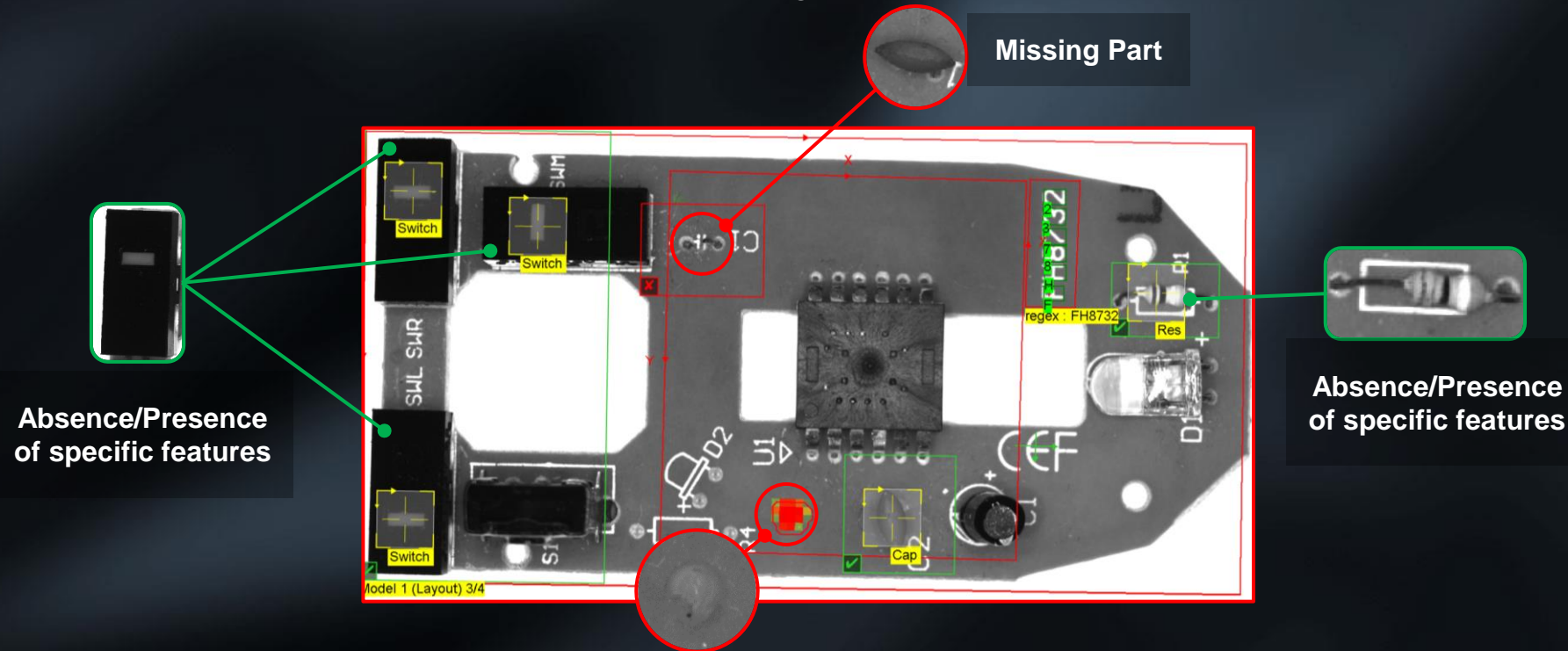


Monochrome

**Challenges:** This complex part can contain a wide variety of defects, making it hard to describe all required characteristics of a good part with rules-based machine vision.

**Solution:** ViDi Check employs an example-based approach to model the full range of PCB features required, tolerating natural part variations while still finding any defects. This inspection also contains ViDi Detect and ViDi Read components.

**Related Applications:** LED PCB, Soldering points



# Mouse PCB Inspection



Electronics PatMax Fixture 5 MP Monochrome

Image Settings Mouse PCB Inspection Trigger Once Pause Online

**NG**

- PatMax Redline  
Match Score: 91.063  
22 ms
- ViDiRead  
Read Result: FH8732  
Match String: FH8732  
40 ms
- ViDiDetect  
7.230  
6.5  
58 ms
- ViDiCheck  
Switches Capacitors Resistors  
43 ms
- Show Graphics
- Show Processing

Processing Time: 90.8921 ms

# MEDICAL SOLUTIONS



## Primary Packaging

Vial cap, crimp, and plug inspection, vial and ampoule body inspection, particulate matter inspection, syringe flange, needle shield, plunger stopper, and needle inspections, needle and syringe assembly verification, prefilled syringe dimensional inspection, prefilled syringe pad printing inspection

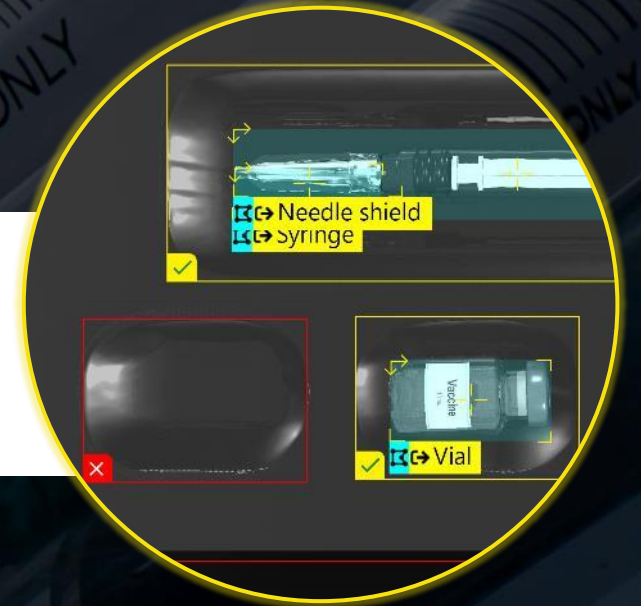


## Warehousing & Distribution

Cold chain storage and distribution, tote routing, label verification and traceability, parcel sorting and processing

## Secondary Packaging

Vial and ampoule counting, vaccine kit assembly verification, patient information leaflet confirmation, packaging inspection and OCR, barcode reading and verification



# Glass Vial Defect Detection



Medical



PatMax Fixture



5 MP



Monochrome

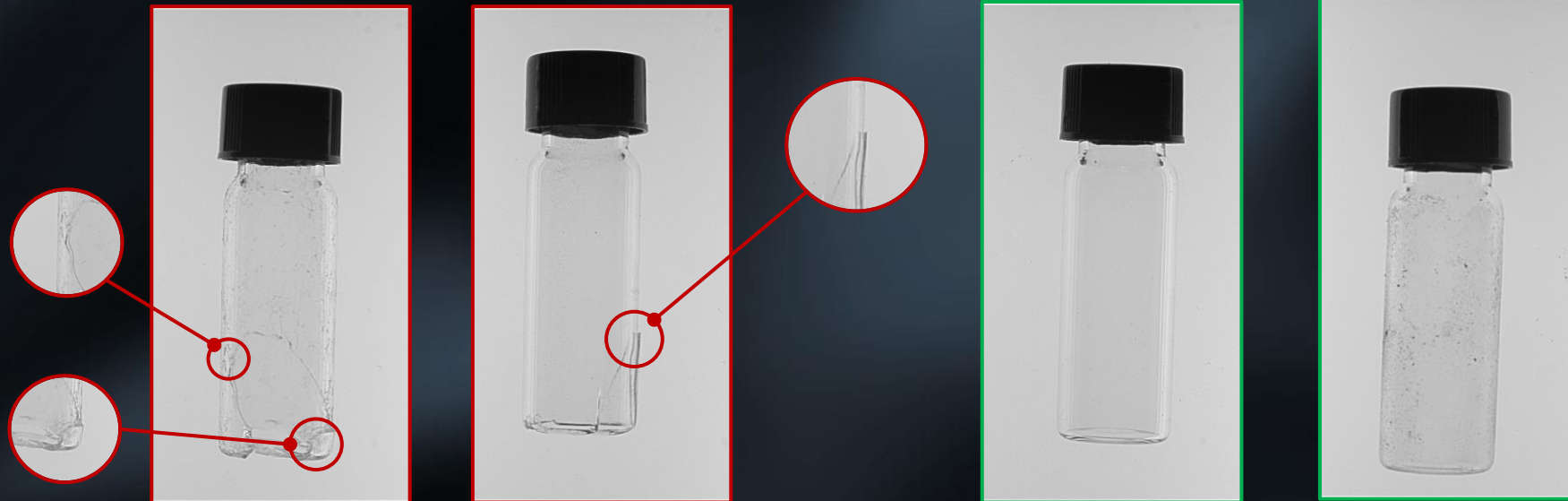
**Challenges:** The transparent part makes it difficult to distinguish breakage from debris along the front or back. The reflective surface also creates variability that would challenge tradition rules-based vision.

**Solution:** ViDi Detect can accurately distinguish natural part variation from anomalies by training on a reference set of good parts at variable lighting conditions and debris levels.

**Related Applications:** Transparent packaging, Manufacturing in a dirty environment

NG X

OK ✓



# Glass Vial Defect Detection



Medical



PatMax Fixture



5 MP



Monochrome

Image Settings Glass Vial Inspection Trigger Once Pause Online

**NG**

Inspection Score Tracking

Inspection Settings

Sample Density	4
Score	8.526
Threshold	7.5

Show Graphics  
 Show Processing Time

Processing Time: 524 ms

# Medical Kit Assembly Verification



Medical



Blob Fixture



5 MP

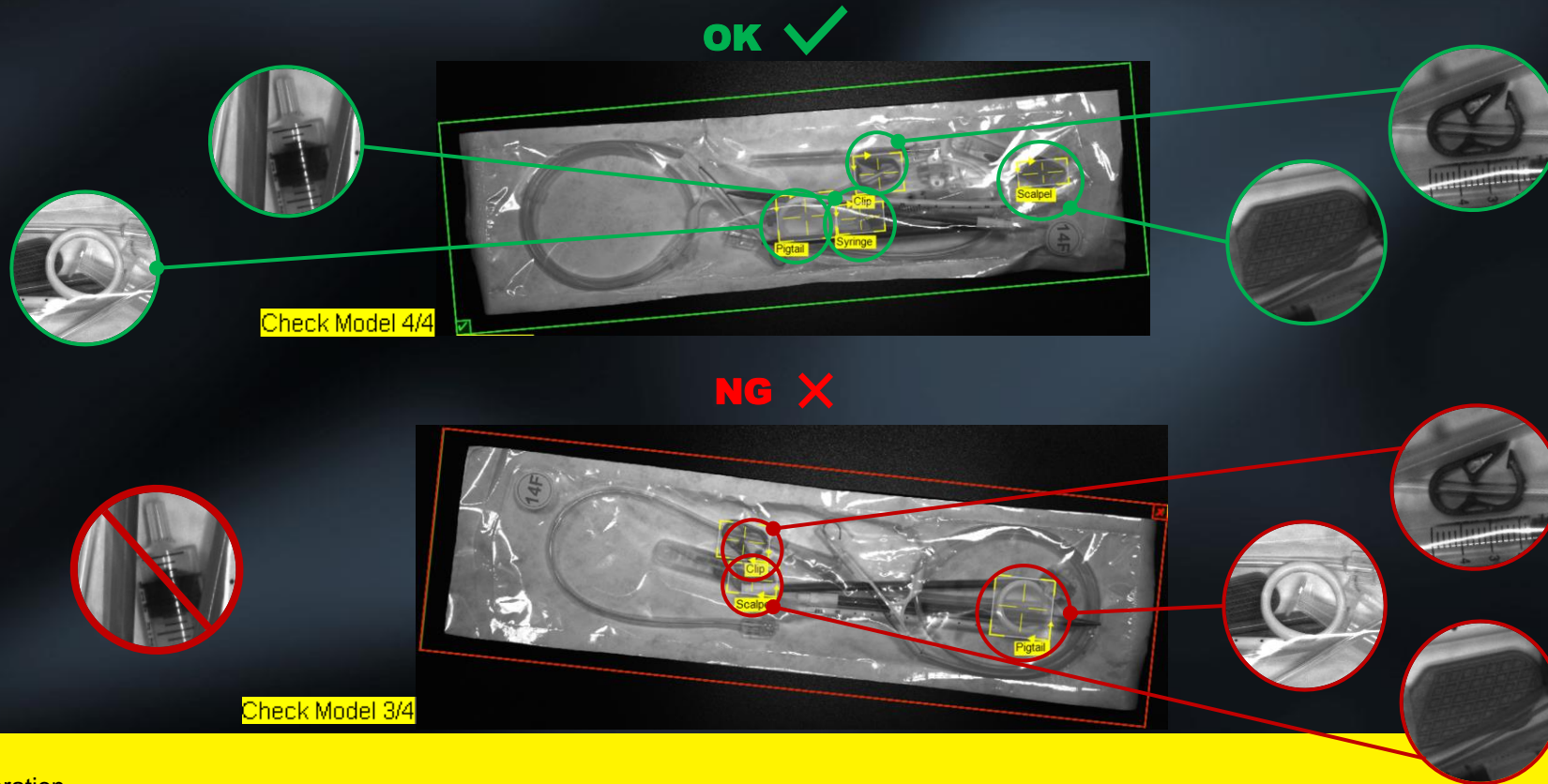


Monochrome

**Challenges:** Elements must be identified through a transparent medical bag, which can be reflective and obscure their appearance.

**Solution:** ViDi Check finds the bag within the frame, then determines whether all four trained features are present.

**Related Applications:** Transparent food packaging, glass containers



# Medical Kit Assembly Verification



**+** Medical    **✂** Blob Fixture    **5 MP**    **●** Monochrome

**Image Settings**    **Medical Bag**    Trigger Once    **Pause**    Online

**NG**

**Check Features**

- Clip
- Scalpel
- Syringe

Show Graphics

Show Processing Time

The image shows a medical kit assembly in a clear plastic bag. Two yellow detection boxes are overlaid on the image, labeled 'Syringe' and 'Clip'. The 'Syringe' box is positioned over a syringe, and the 'Clip' box is positioned over a pair of forceps. The bag is placed on a dark surface. The interface also shows a 'Medical Bag' title, 'Image Settings' button, and various control buttons like 'Trigger Once', 'Pause', and 'Online'. A 'Check Features' panel on the right lists 'Clip', 'Scalpel', and 'Syringe', all with checked boxes. Below this, there are checkboxes for 'Show Graphics' (checked) and 'Show Processing Time' (unchecked). At the bottom, there are four green circles and one red square, likely representing different stages or components of the assembly process.

# Blister pack Inspection



Medical



Blob Fixture



5 MP

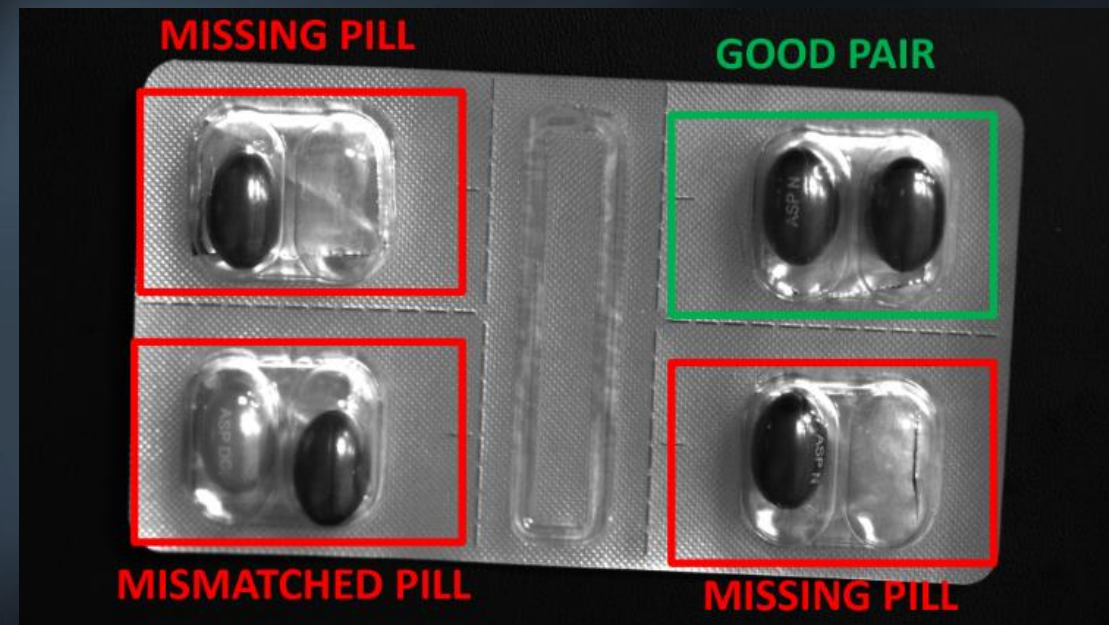
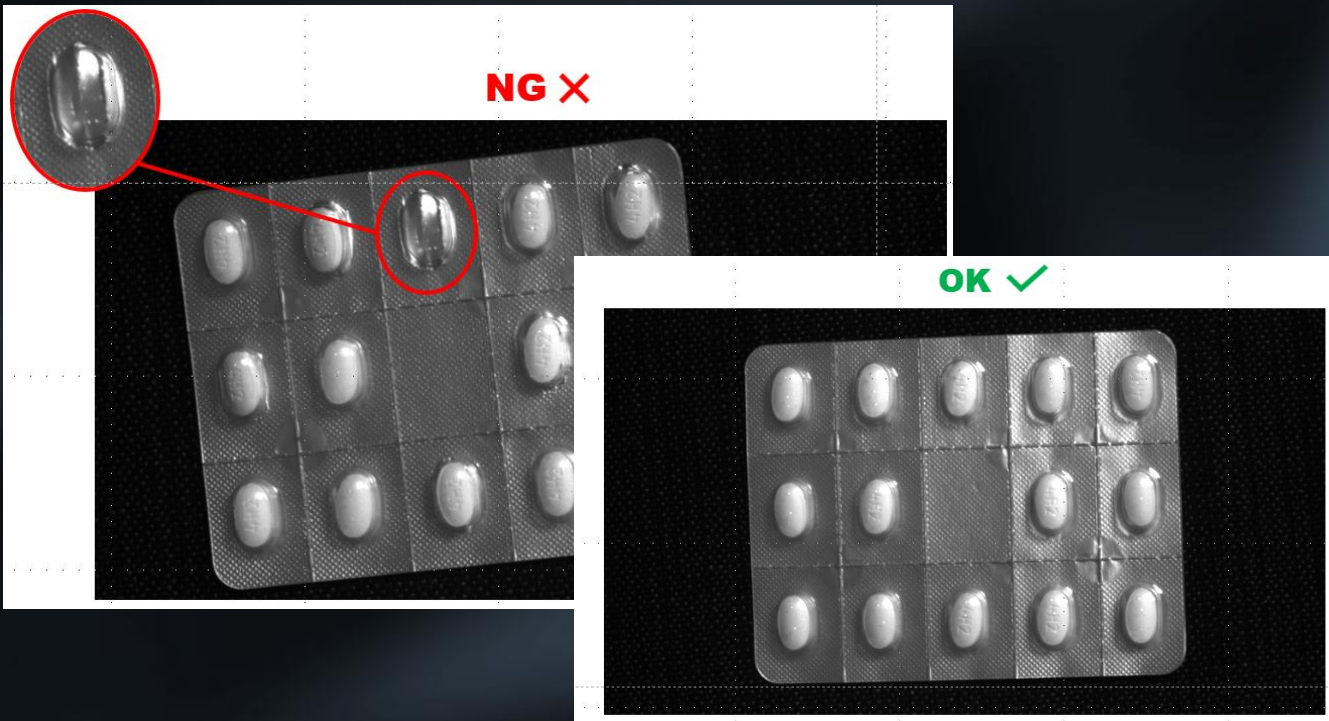


Monochrome

**Challenges:** Elements must be identified through a transparent Blisters, which can be reflective and obscure their appearance.

**Solution:** ViDi Check finds the elements within the frame, then determines if the correct type is present and all Blisters are occupied

**Related Applications:** Transparent food packaging, glass containers



**But how do I know if my Deep Learning Application works reliable ?**

# **WORLDWIDE** SALES AND SUPPORT



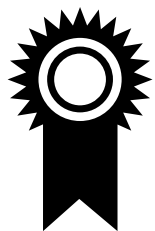
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# THANK YOU!



<https://www.youtube.com/user/CognexTV>