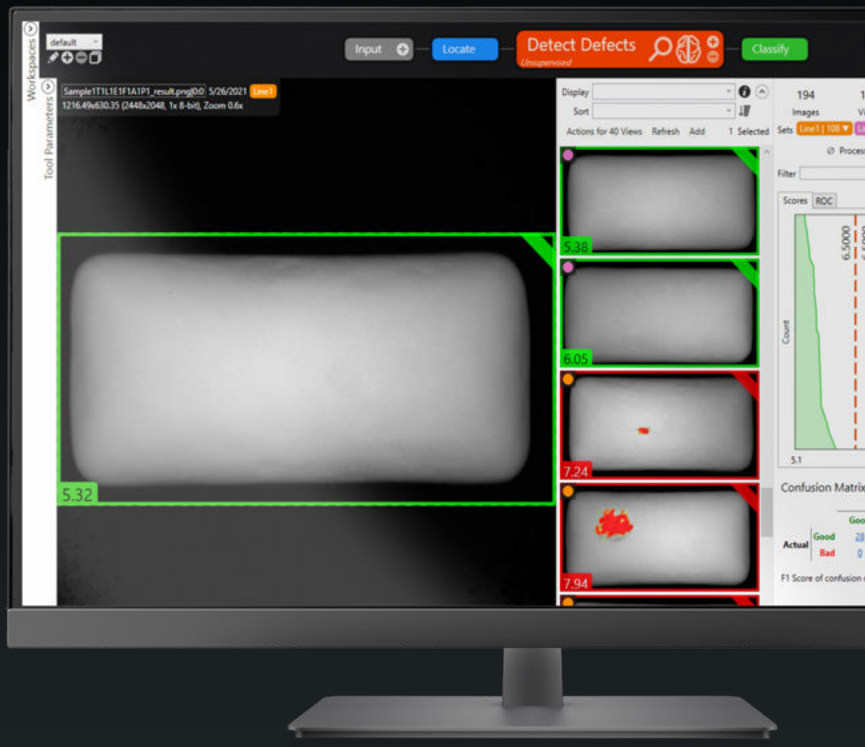
COGNEX

Advanced AI software for complex manufacturing challenges

VisionPro Deep Learning



AI-powered image analysis for demanding applications

Designed for applications that exceed the capabilities of traditional rule-based algorithms, VisionPro® Deep Learning automates inspection processes with superior accuracy and speed, enabling fast and consistent defect detection, assembly verification, classification, character reading, and more.

With example-based learning, VisionPro Deep Learning reduces development time to solve advanced applications and handles variability without the hassle of complex rules and parameters. The software allows users to leverage state-of-the-art technology to build reliable inspection systems and enhance both production yield and quality.

KEY FEATURES

Few sample mode

Get high performance with minimal training images, speeding up development and improving overall efficiency.

See page 4 →

Robust mode

Achieve consistent, reliable results in challenging environments and seamlessly scale projects across multiple lines without any loss in performance.

See page 5 →

Outlier score

Use a metric to identify outlier images and detect changes in production line conditions.

See page 6 →

Multi-class segmentation

Detect and isolate multiple object classes using a single tool for greater precision and efficiency.

See page 6 →

Expedite development with intuitive graphical training

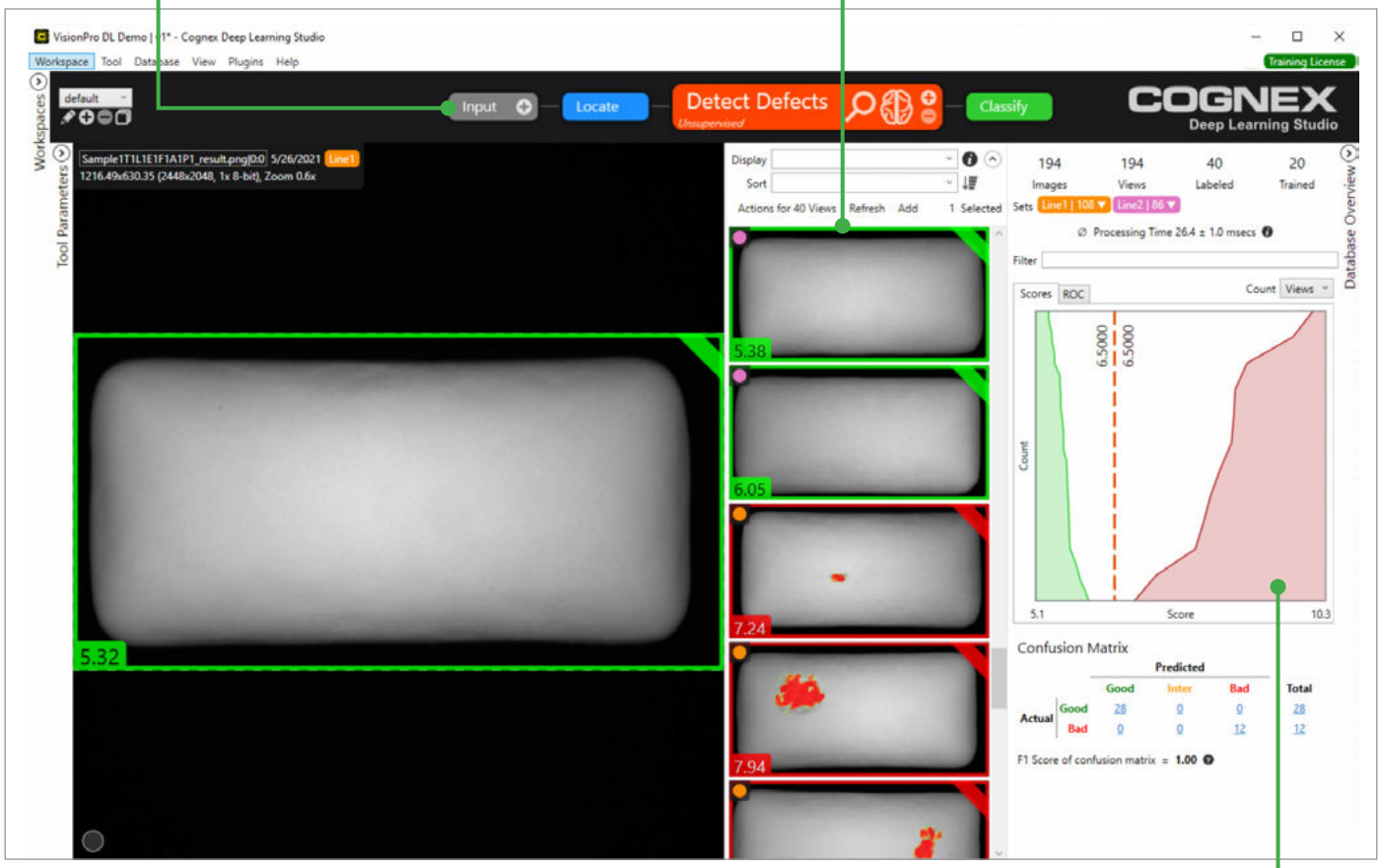
Simplify collecting images, training the neural network, and testing

Tool-chaining

Unique tool-chaining capability lets users break down their problem into smaller steps, making it easier to achieve target performance.

Labeling

The quick labeling and review process reduces the number of images and time needed for setup.



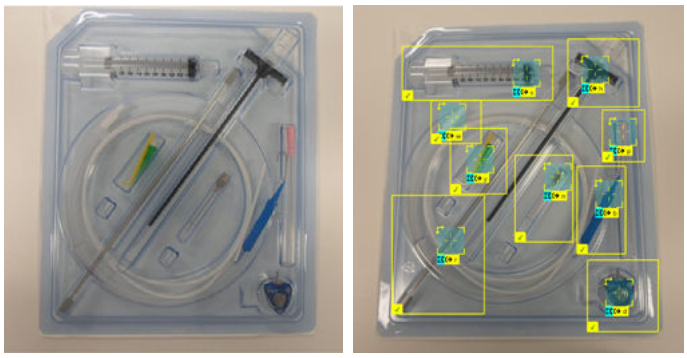
Training

Simplified training and re-training allows for easy deployment and expansion to accommodate multiple products and lines.

Parameter autotune calibrates deep learning models faster than conventional methods.

Automate your most demanding vision applications with an innovative toolset

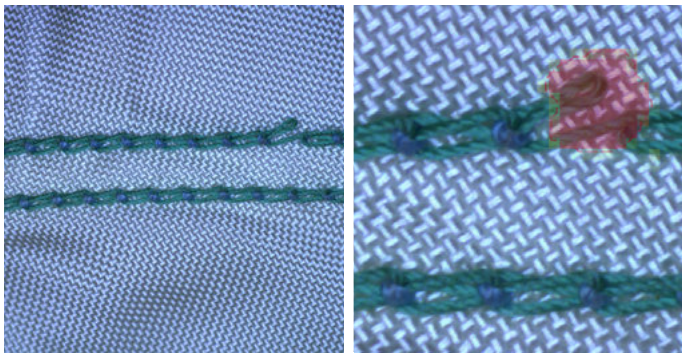
Complete set of powerful deep learning tools meets all your needs



Fixturing, counting, and assembly verification

Blue Locate

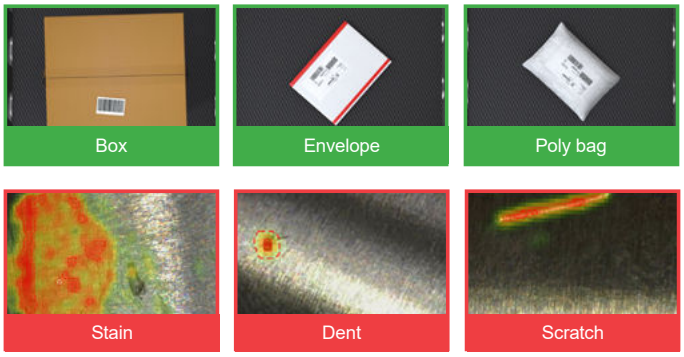
The Blue Locate tool reliably finds features on noisy backgrounds, in low-light environments, on low-contrast parts, and on parts with significant variation.



Defect detection and segmentation

Red Analyze

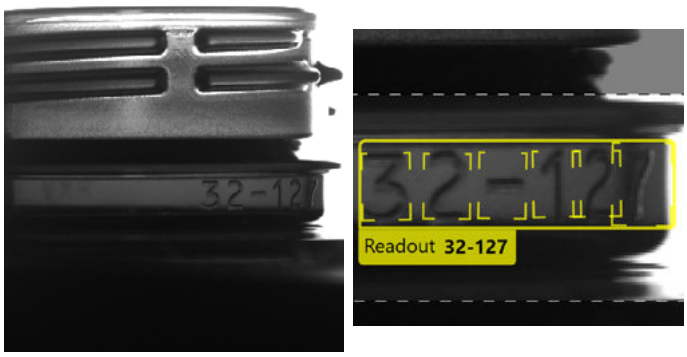
The Red Analyze tool detects subtle defects on a variety of backgrounds and surface textures, while adapting to changes in lighting, positioning, and defect type.



Object and scene classification

Green Classify

The Green Classify tool solves challenging classification tasks by sorting products into categories based on common characteristics, such as color, texture, materials, packaging, and defect type, while tolerating natural variations within each class.



Text and character reading

Blue Read

The Blue Read tool deciphers deformed, skewed, and poorly etched text and codes, as well as complex, application-specific text.

Scale projects with specialized modes designed to address deep learning pain points

Change between modes without re-labeling images and evaluate which one best suits your requirements

Few Sample Mode: High performance, few training images

Few sample mode is powered by a completely new architecture that provides users with powerful results using only a few images per class. This mode significantly reduces development time, can be used with both small and large datasets, and provides improved heatmaps.

Addresses data scarcity

Few Sample Mode is ideal for applications where data is limited, for instance, when defect images are scarce, only a few parts are available for a feasibility study, or when dealing with imbalanced classes.

Scalable for larger datasets

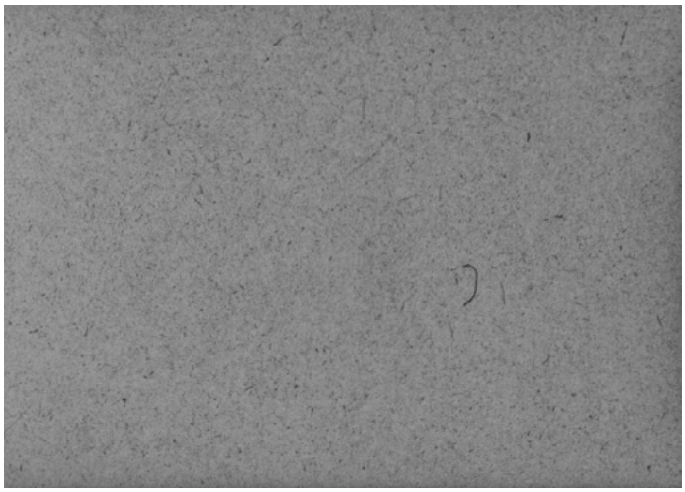
The model maintains high performance even when scaled to accommodate large amounts of data and improves in accuracy as more data is collected.

Simple and efficient training

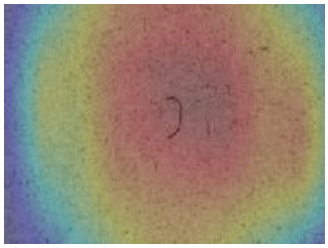
With few training parameters, Few Sample Mode is easy to optimize, streamlining the training process and development process.

Precise heatmap generation

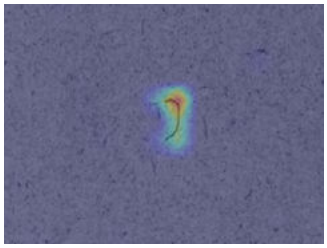
Few Sample Mode produces highly precise and detailed heatmaps, enabling users to understand which areas of the image influenced the classification output.



Raw image of defect



Heatmap using other modes



Heatmap using
Few Sample Mode

Robust Mode: Reliable performance in challenging environments

Robust Mode is a deep learning architecture* that handles environmental challenges like camera tilt, lighting changes, and white balance shifts, ensuring consistent performance across these optical variations.

Environmental resilience

This model outperforms other models in fluctuating or challenging optical conditions, making it ideal for unstable operational environments.

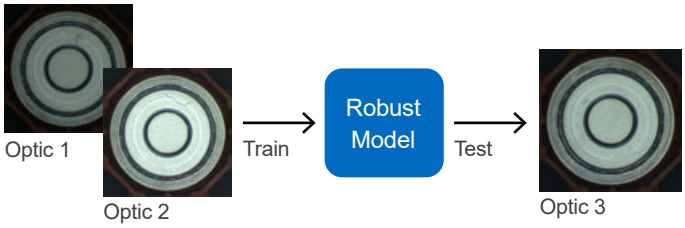
Efficient multi-line deployment

Robust Mode can be deployed to multiple lines without the need for costly re-training, enabling projects to scale faster.

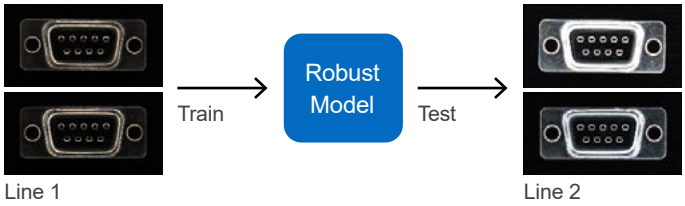
Long-term reliability

Built for durability, this model ensures consistent, high-quality inspections over time.

Use case: Unstable environment for a single line



Use case: Early performance boost for a new line



*Only available with Green Classify and Red Analyze tools

Enhanced usability features

Upgrade your inspections with enhanced data management, higher accuracy, and early access to innovative technology

Outlier score: Instantly detect production line changes

The outlier score compares images to a trained dataset to determine whether they align with expected patterns. This feature enables users to monitor environmental changes in production, track deviations from standard patterns, and filter unusual images for further analysis or retraining.

Detect environmental changes

Indicates variations in lighting conditions or camera setups, which may impact the consistency of images over time.

Identify product changes

Detects shifts in product components, new products, or pattern alterations, ensuring any unexpected differences are flagged for review.

Optimize data retention

Helps users to only retain relevant images for future model updates, improving the efficiency and relevancy of production image datasets.

Class A
Low outlier score

Class B
Low outlier score

Class C
Low outlier score

Not trained
High outlier score

Multi-class segmentation: Enhanced accuracy and usability for advanced image analysis

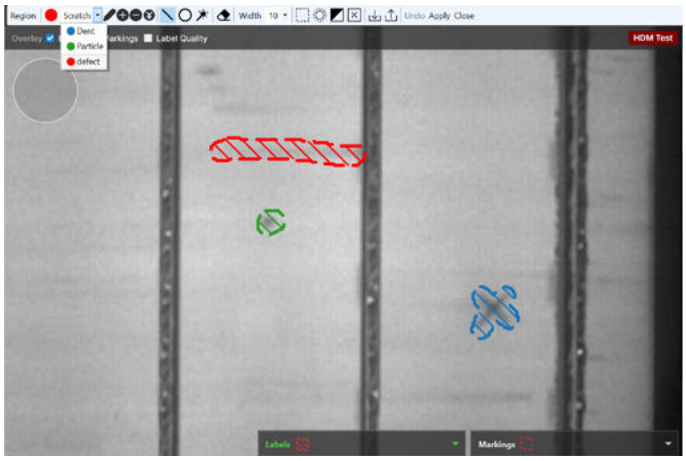
Multi-class segmentation detects and separates multiple object classes within a single image, allowing users to identify and isolate different categories or regions of interest at the same time.

Support for complex applications

Offers a more efficient and powerful solution for handling advanced multi-class segmentation tasks.

Streamlined workflow

Eliminates the need for separate segmentation and classification “toolchains,” simplifying data management and analysis.



Region Area Metrics

Region	Recall	Precision	F-Score
Dent	62.2	69.8	65.8
Particle	0.0		
Scrach	0.0		

Lab Feature

Access to cutting-edge beta functionality

The Lab Feature allows users to explore the latest innovations and functionalities before they are officially released, offering a hands-on experience with advanced tools.

Early access to new tools

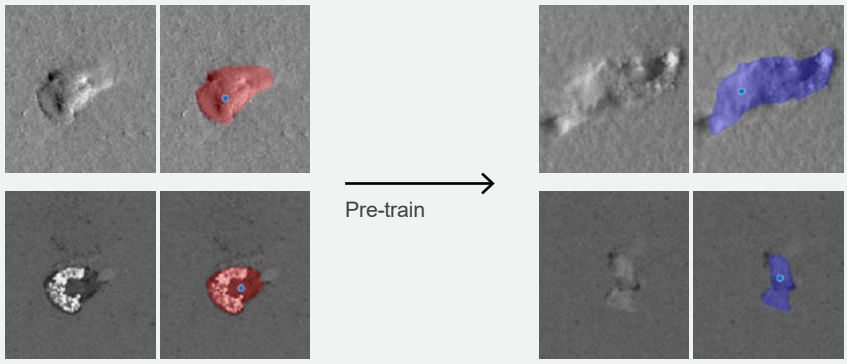
Test upcoming features and updates to stay ahead of the curve.

Influence future development

Provide direct feedback to shape and refine new capabilities.

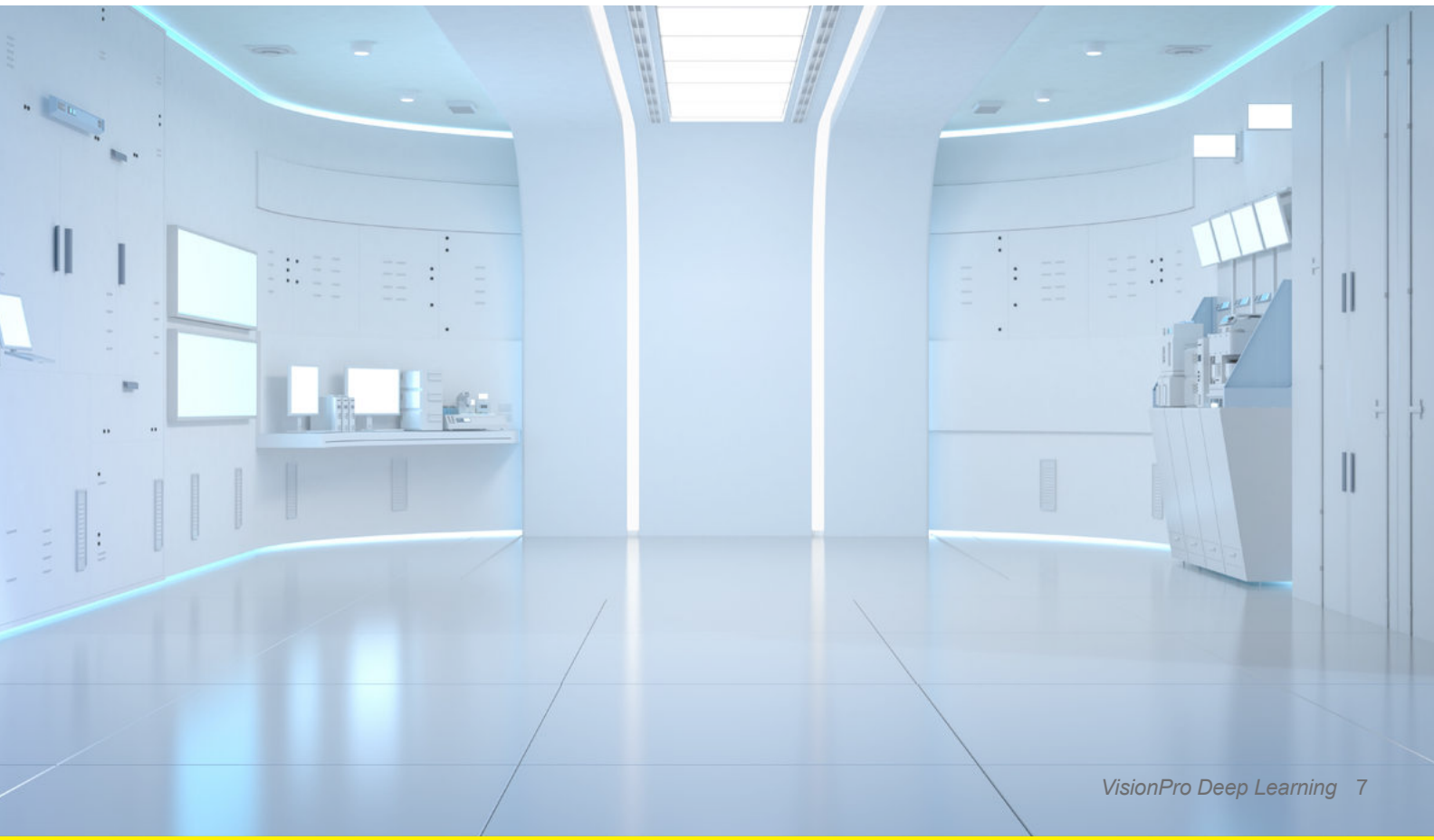
Speed up training with assisted image labeling

Quickly pre-train the AI by labeling a few images. The system will then auto-generate areas for review, which can be confirmed or adjusted.



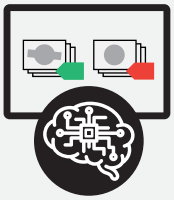
Manual label

Auto-created label



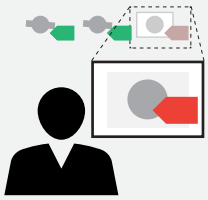
Tackle key challenges at every stage of the deep learning project cycle

Labeling



AI-powered labeling

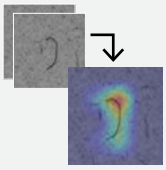
Simplify the process of labeling defects with AI-assisted technology



Label Checker

Flag problem images for review, saving time and effort over manually checking each one

Training

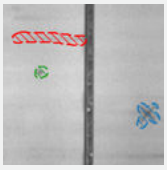


Few Sample Mode

Train with minimal data and generate precise heatmaps

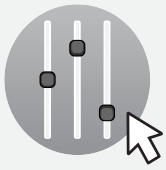
Robust Mode

Ensure accurate system duplication across production lines, even with optical differences



Multi-class segmentation

Define and detect multiple classes with a single tool



Parameter autotune

Quickly set up applications with one-click optimization

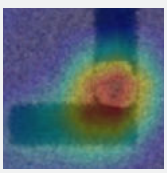
Deployment

Outlier score

Identify and evaluate anomalies to improve accuracy

TensorRT

Increase processing speed using the latest TensorRT technology



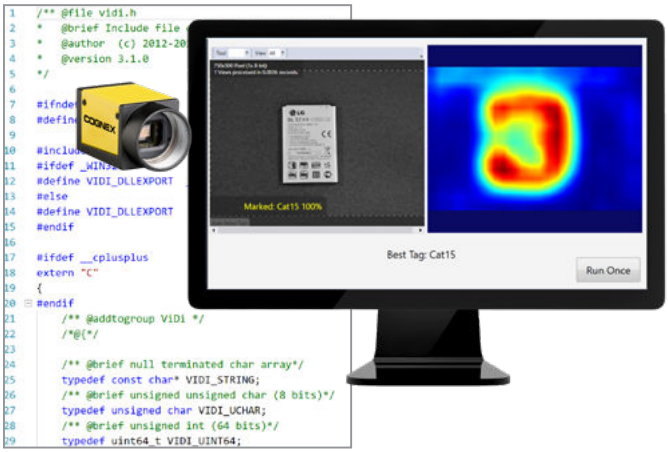
Detailed heatmaps

Easily see which parts of an image a deep learning model finds most significant

Scale your operations with flexible common development environment

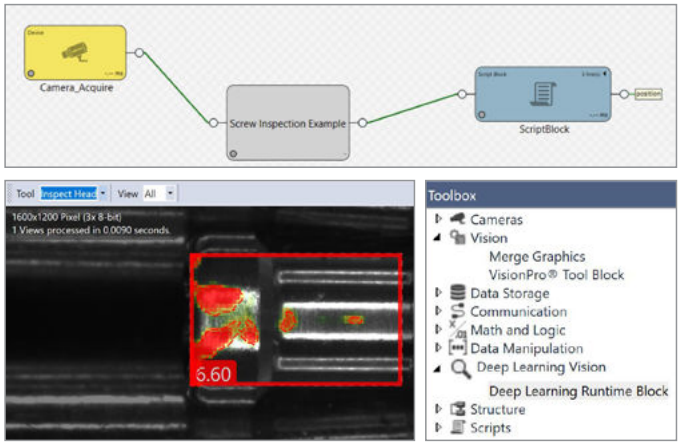
From low-level machine integration to building an application-specific HMI, VisionPro Deep Learning provides flexibility in how you develop and deploy vision inspections in your production environment.

Tight integration with existing software and vision products creates greater compatibility across the Cognex product portfolio and allows you to introduce the latest technologies without duplicating engineering costs. It also enables you to adapt an existing job to new or additional lines, delivering quick deployment in mass production environments.



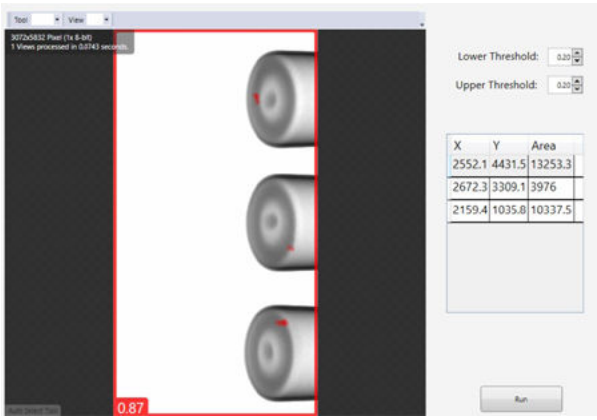
Programmatic integration

Easily convert images, graphics, and results between VisionPro and VisionPro Deep Learning.



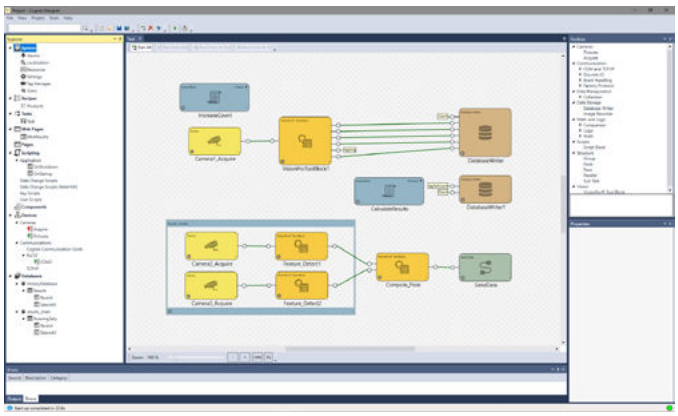
Graphical prototyping

Integrate deep learning workspaces into Cognex Designer to simplify image acquisition, results processing, and I/O.[1]



Fully deployable applications

Create and deploy VisionPro and deep learning applications using Cognex Designer.[2]



Backwards and forwards compatibility meet every vision need

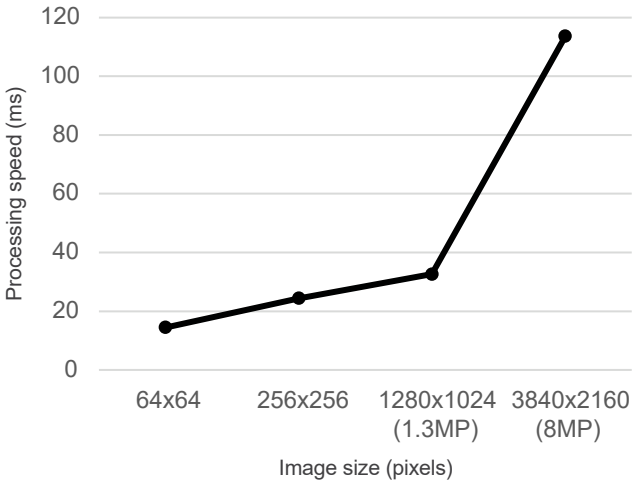
Train in the standalone Deep Learning Studio or load a deep learning workspace into Cognex Designer.

[1] Only available in VisionPro Deep Learning 2.0
[2] Only available in VisionPro Deep Learning 1.1

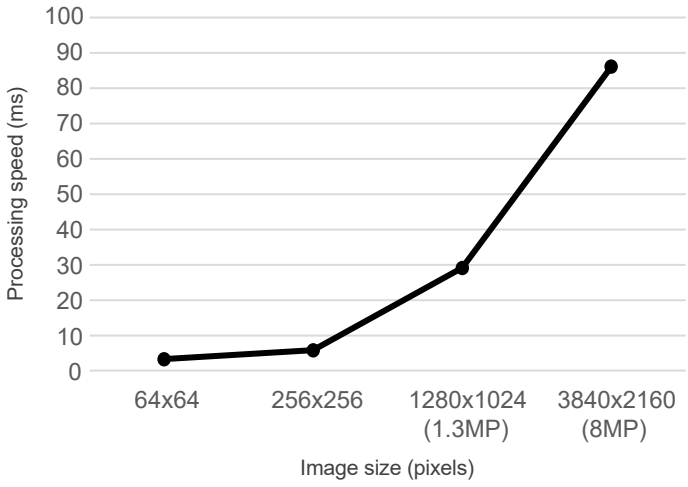
VisionPro Deep Learning Specifications

Graphical & application programming interfaces		Windows based graphical user interface (GUI) with plugin support C library (Windows DLL) for runtime and/or training Microsoft .NET library (Wrapper for C library and WPF GUI components)
Hardware & OS Requirements	CPU	Intel Core i7 or higher (recommended)
	GPU	Cognex only supports NVIDIA GPUs Recommend GPU memory of 11GB or higher (GTX 1080Ti, RTX 2080Ti, 3070, 3080, 3090) Note: VisionPro Deep Learning performance — in terms of processing time — will depend on hardware selection
	RAM Memory	32 GB or more (recommended)
	USB	1 free USB port (for the license dongle)
	OS	Windows 10 64-bit Windows Server 2019 64-bit
	Storage	Solid-state drive (SSD) with 100 GB or more of free space (recommended)
Supported image file formats		PNG, BMP, TIFF, JPEG
Supported image properties		1–4 channels, 8 or 16 bits

Green-Classify Tool Speed



Red-Analyze Tool Speed



Measurements are approximate and for guidance purposes only.
This can vary on images and PC Environments.
Test PC Spec: CPU: i9-10900KF / GPU: RTX 3080

COGNEX

Companies around the world rely on Cognex vision and barcode reading solutions to optimize quality, drive down costs, and control traceability.

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