



# Lenovo Industrial Computer Vision

Lenovo

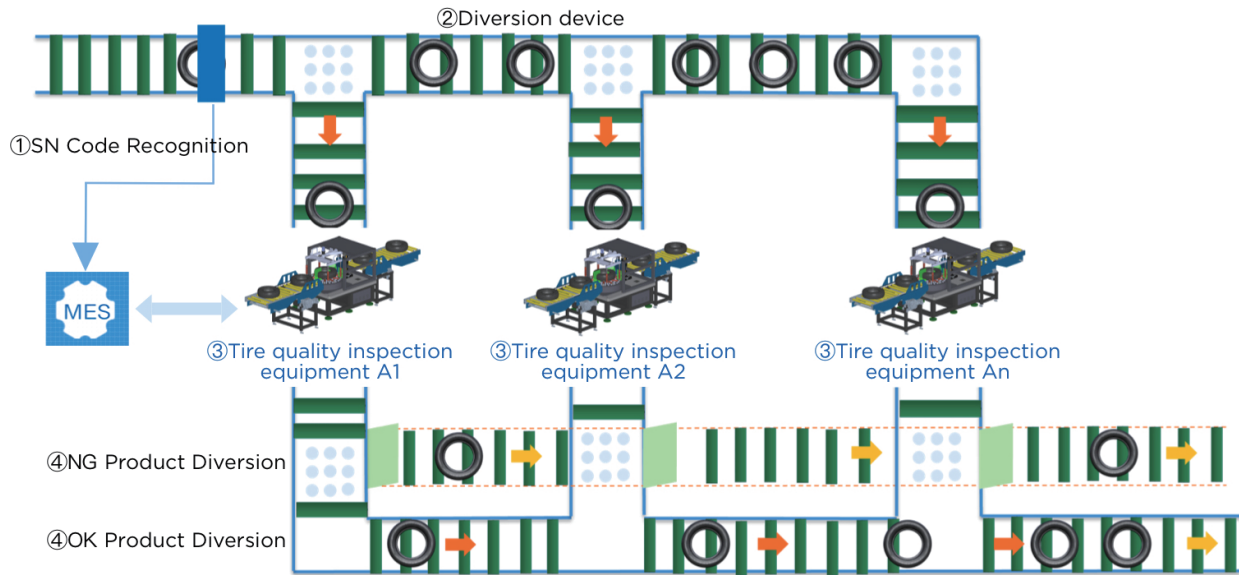
## Tire Inspection

Tire manufacturers face mounting pressure to deliver flawless products at ever-increasing production speeds. Subtle surface defects across the crown, sidewall, shoulder, bead, and cavity are notoriously difficult to detect on dark, uniformly colored rubber surfaces—yet the consequences of a missed flaw can range from costly recalls to serious safety liabilities. Traditional manual inspection, long the industry's fallback, introduces unavoidable inconsistencies driven by human fatigue, subjective judgment, and shift-to-shift variability, while also creating persistent staffing and training burdens. Automated alternatives, meanwhile, have often forced manufacturers into an uncomfortable trade-off: tighten sensitivity and face a flood of false rejects that inflate scrap costs, or loosen thresholds and risk letting genuine defects slip through. As regulatory standards grow stricter by the year, the need for a smarter, more reliable inspection solution has never been greater.

Lenovo Industrial Computer Vision - Tire Inspection was purpose-built to answer these challenges. Integrating advanced mechanical and optical design with high-definition industrial cameras, the system captures full-area image data across all critical tire surfaces—crown, sidewall, shoulder, bead, and cavity—at production line speed, eliminating the bottleneck between throughput and inspection rigor. Powered by Lenovo's proprietary few-shot lifelong learning technology, the system achieves rapid, accurate modeling of tire surface defects, dramatically reducing both false positives and false negatives without lengthy retraining cycles. Beyond comprehensive detection, it delivers precise defect classification and quantitative measurement, feeding rich, traceable data back into production workflows so manufacturers can close the loop between detected anomalies and upstream root causes. This solution drastically improves detection efficiency and accuracy—empowering tire manufacturers to meet the highest quality standards while achieving significant, measurable cost reduction.



## Solution architecture



### ✓ SN Code Recognition:

Obtain tire information through the MES (Manufacturing Execution System) and synchronize it to the diversion device.

### ✓ Diversion device:

The device distributes the tires to the corresponding quality inspection equipment.

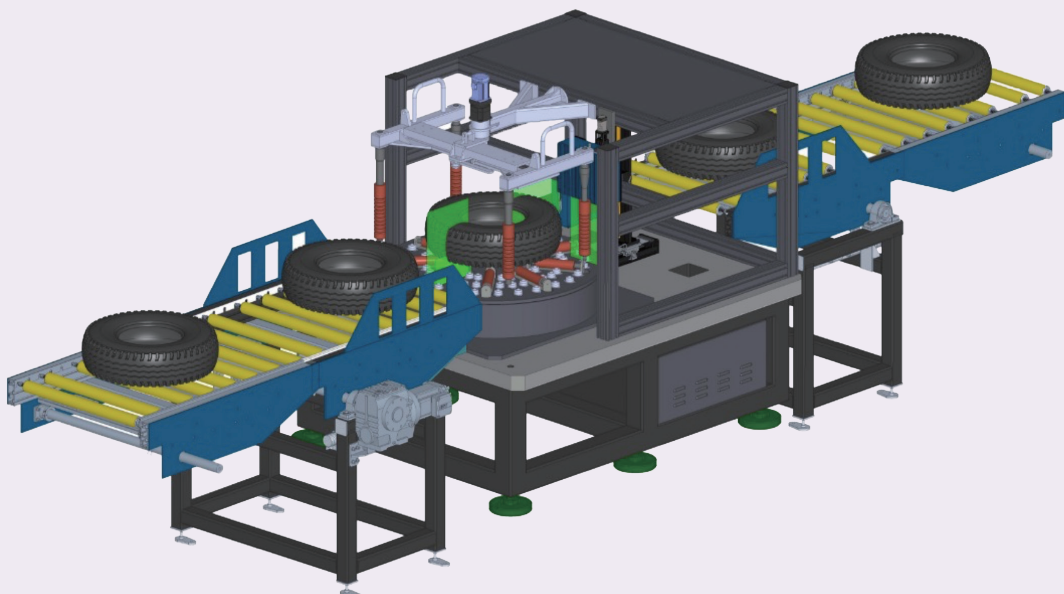
### ✓ Inspection:

The inspection equipment conducts image collection and defect inspection on the tires.

### ✓ Product Diversion:

Divert the inspected tires into OK products and NG products.

## System Configuration



## Types of detectable defects

Crown	Rubber shortage, Blister, Pattern misplaced, Exposed cords, Vagrant cords, Cracks at the tire crown joint, Rounded corners of the pattern, Crown deformation etc.
Sidewall	Rubber shortage, Cracks, Scratches, Blister, Wrinkling of the sidewall, Exposed cords, Exposed steel wires, Abnormal movable blocks, Wrinkling on the sidewall, Trademark & year and week code etc.
Shoulder	Rubber shortage, Cracks, Scratches, Blister, Non-uniform etc.
Tire Cavity	Rubber shortage, Cracks, Scratches, Blister, Exposed cords, Barcode defects, Scaling at the bead etc.
Bead	Rubber shortage, Cracks, Scratches, Blister, Non-uniform etc.

## The detectable range of tire sizes

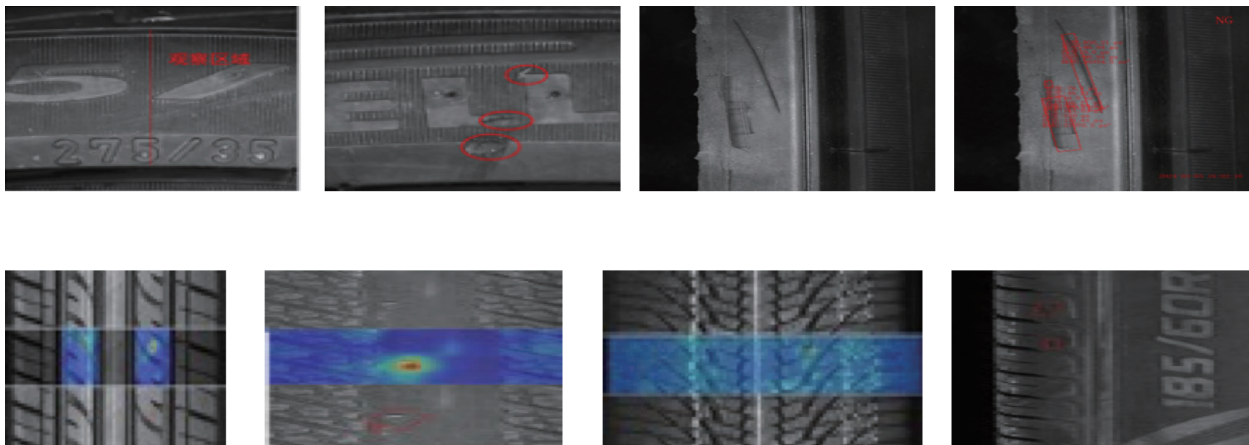
### PCR (Passenger Car Radial)

Name	Minimum size	Maximum size
Section width	110 (mm)	355 (mm)
Section height	70 (mm)	210 (mm)
Rim diameter	12 inches (304 mm)	24 inches (610 mm)
The outer diameter of the tire	400 (mm)	1000 (mm)
The distance between tire toes	70 (mm)	325 (mm)

### TBR (Truck and Bus Radial)

Name	Minimum size	Maximum size
Section width	135 (mm)	510 (mm)
Section height	150 (mm)	320 (mm)
Rim diameter	15 inches (381 mm)	25 inches (635 mm)
The outer diameter of the tire	700 (mm)	1400 (mm)
The distance between tire toes	80 (mm)	400 (mm)

## Detection effect





## High-Performance General-Purpose AI Engine

Built on Lenovo's fully self-developed pre-trained foundation model for quality inspection and few-shot lifelong learning technology, it achieves pixel-level accurate recognition and universal adaptation across multiple tire models, eliminating repetitive debugging for individual models.



## End-to-End Integrated Solution

With an integrated design combining optics, mechanics, electronics, computing, and software, multiple light sources and cameras work in synergy to enable dead-angle-free detection of full tire surface defects, addressing all tire appearance inspection needs in a single solution.



## Millisecond-Level Multi-Model Switching

Supports second-level SKU switching for various tire models, perfectly adapting to mixed inspection requirements on complex production lines, reducing manual model-switching operations and saving significant production time.

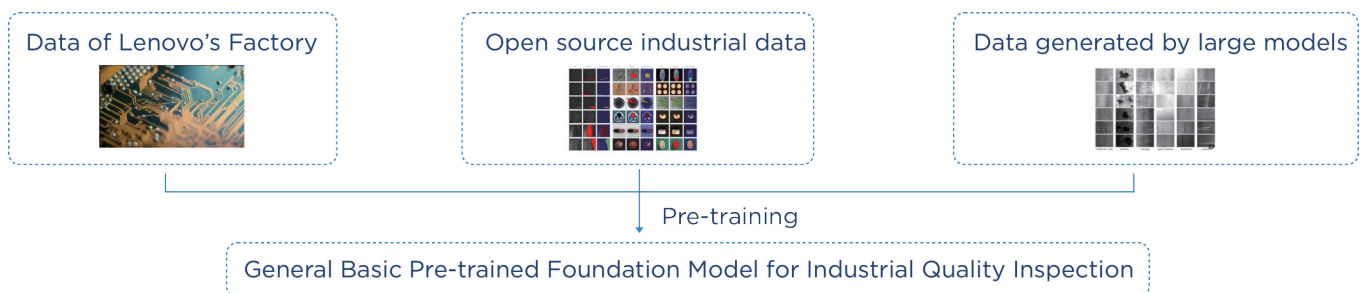


## Efficient System Integration & Management

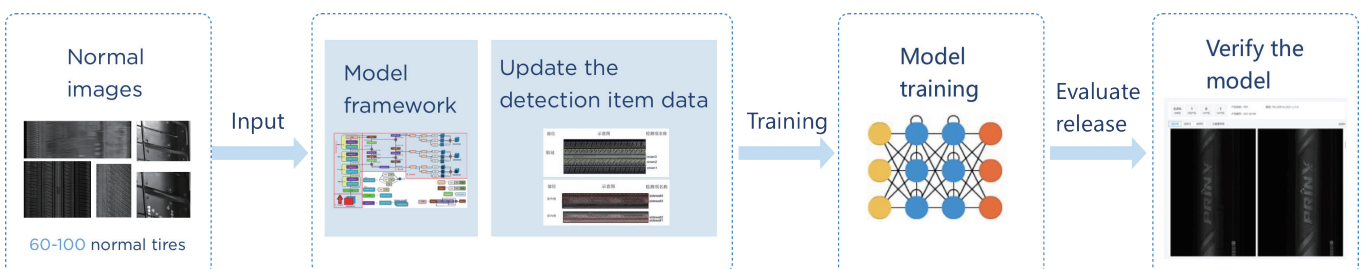
Seamlessly connects with the factory's MES system, enabling interconnection between inspection and production data, optimizing the overall production process, and effectively reducing operational costs for enterprises.

## Core technology

### Lenovo Industrial Quality Inspection - Foundation Model



### Unsupervised algorithm training and inference system based on few-shot



## Main Advantages

### ✓ Few-Shot Unsupervised Modeling Technology for Qualified Products

Leveraging a large industrial quality inspection model, it enables minute-level rapid modeling using only a small number of qualified positive samples, significantly reducing sample collection and annotation costs during the modeling process.

### ✓ Integrated Edge Training & Inference with Self-Learning Capability

Equipped with an integrated edge-side local training and inference architecture, it achieves "learning during inspection and optimization during use." Detection accuracy improves continuously through real-world operations, adapting to process fine-tuning and scenario changes in production.

### ✓ Multi-Technology Integration for Complex Scenario Adaptation

Seamlessly integrates machine vision and automation technologies, overcoming the limitations of single-technology applications. It addresses complex quality inspection needs across multiple industries and scenarios with exceptional adaptability.

### ✓ Advanced Algorithms, Breaking Sample Bottlenecks

Combines unsupervised and supervised dual detection modes, effectively addressing the challenge of scarce defect samples. By empowering production with AI technology, it significantly enhances enterprise quality inspection efficiency and overall productivity.

## Customer Value

### Case Reference:

For a tire manufacturing enterprise producing **20,000** semi-steel tires daily across **150** SKUs, the equipment delivers the following value upgrades:



# 1.5x

Improvement in  
Production Efficiency



# 50%

Reduction in Defect  
Omission Rate



# 60%

Savings in Quality  
Inspection Labor  
Costs



# Features

- **Full-Area Coverage & Dead-Angle-Free Detection**

Industrial cameras enable defect detection across all tire areas, including the crown, sidewall, shoulder, bead, and cavity, ensuring no blind spots.

- **Pixel-Level High Precision**

Detection accuracy using 2D and 3D industrial cameras reaches 5×5 pixels, capturing even tiny defects with precision and eliminating missed or false detections at the source.

- **Standardized & Visualized Result Display**

Inspection results are presented on a standardized interface, supporting dual-dimensional queries by tire inspection section and acquisition camera. Inspection data is clear, intuitive, and enables quick traceability.

- **Defect Detail Tracing & Quantitative Analysis**

Supports zoom-in viewing of defect details, accurately labeling defect positions, names, and quantitative indicators, providing precise data for analysis and process optimization.

- **Multi-Specification Adaptation with Single Equipment**

A single device is compatible with inspecting tires of various sizes and specifications, eliminating the need for additional specialized equipment and reducing enterprise investment costs.



## Lenovo's global strength

**180**

Markets

**10M+**

Order lines per year

**1B+**

Global customers

**120M+**

Shipments

**30+**

Global manufacturing sites

**2000+**

Suppliers

**>\$160M**

Digital transformation investment

**18**

R&D locations worldwide

**69.5K**

People



Global Supply Chain  
Ranked 8<sup>th</sup> by Gartner



World Economic  
Forum's Global  
Lighthouse Network



TITAN Business Awards



BIG Awards for  
Business - Product of  
the Year

# Smarter inspection, lower cost — Tire Surface Defect Full-inspection Equipment

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