A practical guide to AI OCR

How AI-powered optical character recognition transforms date and lot code inspection in high-speed manufacturing

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ZEBRA

Hidden risks in high-speed production

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The problem of quality control

On modern production lines, date and lot codes do more than mark packages. They support traceability, protect consumers, and play a direct role in compliance. When a code is missing, unreadable, poorly printed, badly positioned, or simply incorrect, there can be cascading consequences.

Date and lot code verification has to succeed under tough conditions: fast-moving lines, shifting containers, changing print quality, and surfaces that can be curved, glossy, reflective, transparent, or textured. Manual sampling creates blind spots between checks, and older OCR tools cannot keep up with real-world variability.

What happens when inspections fail?

- Rework and wasted product
- Retailer chargebacks or rejected products
- Late-stage troubleshooting and downtime
- Compliance exposure and recall risk

Manufacturers need a way to validate every code at line speed. That's where AI-powered OCR machine vision comes in.

How AI OCR sees what others miss

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Pattern recognition versus rule-based templates

Zebra's AI-powered OCR uses deep learning to recognize characters based on patterns and context. Instead of matching individual letters to a fixed template, it leverages an AI model that can deal with distortion, partial obstructions, different marking methods, and difficult surfaces.

Even better, it's both flexible and resilient, able to adapt immediately to changes in packaging design or materials.

Advantages on the line

- Reads any marking method, including laser, etched, thermal, and more
- Handles continuous inkjet (CIJ) drift, bleed, and fade
- Adapts instantly to curved, reflective, or transparent packages
- Reduces manual tuning and exception handling

Zebra's AI OCR delivers a practical solution for fast, accurate, and reliable date and lot code inspection.

Where traditional OCR falls short

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Built for predictable text, not production lines

Traditional OCR performs best when characters are high-contrast, neatly aligned, and printed on clean, flat backgrounds. That works fine in controlled environments and test conditions, but it's far less reliable on real-world production lines where motion, vibration, glare, low contrast, and random angles are normal. Even minor difficulties like a clogged inkjet nozzle, a shifted or smeared code, or a reflective label can trigger missed reads or false rejects.

Traditional OCR can be appropriate for some workflows, but high-speed packaging calls for something more adaptive.

The hidden costs of conventional OCR

- Image pre-processing and character segmentation
- Manual rule-setting for fonts and layouts
- Reconfiguration when labels, materials, or lighting change

Rule-based OCR follows instructions. AI-powered OCR handles variability.

Superior vision, smarter software

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A complete solution

Zebra combines intelligent Aurora Focus™ software with state-of-the-art NS42 and FS42 smart cameras to deliver highly accurate, high-speed, high-volume optical character recognition purpose-built for date and lot code inspection on food, beverage, and other consumer packaged goods.

Zebra Aurora Focus Software

Configure, deploy, and manage intelligent OCR systems with an intuitive software platform designed for machine vision applications. **See zebra.com/aurora-focus.**

Zebra FS42 Fixed Industrial Scanner

Optimized for resource-intensive tasks like deep learning OCR applications and high-speed scanning with increased onboard memory and a neural processing unit (NPU). **See zebra.com/fs42.**

Zebra NS42 Smart Vision Sensor

Purpose-built for complex machine learning algorithms, with an embedded NPU for deep learning OCR and anomaly detection tools for challenging OCR and inspection tasks. **See zebra.com/ns42.**

Zebra's AI OCR solution achieves near-100% accuracy and read times as fast as 40 ms for typical date and lot codes.

Faster to set up, easier to scale

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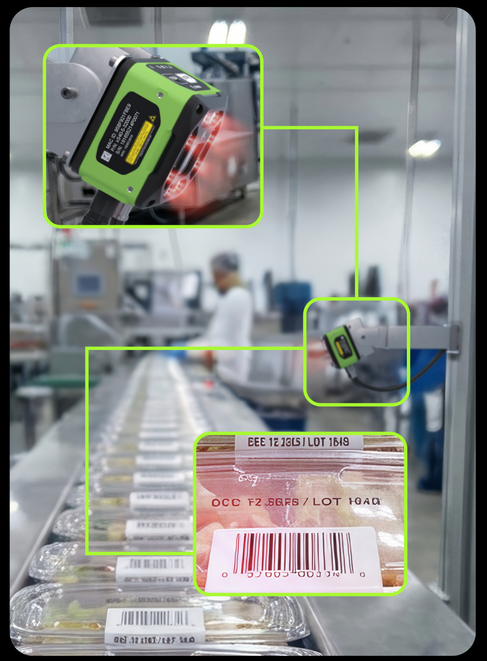
Out-of-the-box intelligence

A major obstacle to OCR adoption is setup time. Conventional systems can require extensive configuration and repeated adjustments. Even those with rudimentary AI capabilities can require hours of image and font training.

Zebra's AI-powered OCR is pre-trained on more than 200 font families and millions of real-world images, as well as varying angles, surface textures, environmental conditions, and marking methods to eliminate costly engineering time.



Skip the setup. Zebra's AI OCR solution deploys out of the box in minutes, not hours.

Built for versatility and scale

Pre-trained intelligence doesn't just accelerate your initial commissioning, it ensures your inspection system is flexible enough to adapt to the unpredictable realities of a modern factory floor.

- **Eliminate batch rework:** Catch printing errors the exact millisecond they happen, ending the costly quarantine, scrap, and rework cycle.
- **Maximize line throughput:** Run at absolute peak capacity (up to 900 ppm) with sub-40 ms read times that never bottleneck production.
- **Expedite line changeovers:** Seamlessly switch between SKUs and seasonal products without requiring tedious font training or engineering downtime.
- **Conquer packaging complexity:** Instantly adapt to new label and packaging designs, reading through harsh glare, shadows, and distortion.
- **Guarantee brand compliance:** Ensure 100% legibility to satisfy strict regulatory mandates (FSMA, MoCRA) and eliminate expensive retailer chargebacks.
- **Future-proof and scale:** Easily duplicate inspection success across multiple reconfigured lines with an out-of-the-box, adaptable AI platform.

The advantages of continuous verification

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From reactive checks to proactive control

Relying on interval-based manual checks or outdated OCR tools creates massive operational blind spots. If a printer clogs or ink fades between scheduled inspections, thousands of compromised products can slip through, forcing you to quarantine, rework, or scrap entire batches.

Zebra's AI OCR technology replaces uncertainty with continuous, real-time verification. By catching legibility issues as they occur, your operations team can stop reacting to downstream disasters and stay in control of production.

Continuous verification with Zebra's AI-powered machine vision is more than just a quality check, it's a proactive safeguard that protects your brand, guarantees compliance, and defends your bottom line.

Immediate operational gains

- Fewer rejects and less rework
- Reduced shipping waste
- Stronger regulatory compliance
- Predictable throughput
- Lower implementation costs
- Maximized line speed
- Faster changeovers

Zebra's AI OCR transforms date and lot code inspection from a challenge to a competitive advantage.

What to expect, and what comes next

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Looking ahead

High-volume manufacturing isn't slowing down. To stay competitive, operations need an intelligent, adaptable machine vision platform built for the pace of tomorrow.

Date and lot code inspections demand an intelligent machine vision solution that can adjust to changing packaging, variable print quality, and accelerating production lines without adding new layers of complexity. A future-ready solution must perform reliably at high speed, deploy quickly, adapt to new materials and print conditions, and support new machine vision capabilities and applications.

That's the promise of Zebra AI OCR.

For more information

Ask your Zebra representative about AI OCR for date and lot code validation, or visit our website for more information: zebra.com/ai-ocr

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