Fewer Defects, Faster Speed
Spyglass Visual Inspection for Manufacturers
Agenda

• The State of IoT Edge & Cloud in manufacturing
• Traditional machine vision systems
• Deep Learning AI
• Spyglass Visual Inspection
• Real-World Customer stories
Microsoft framework for intelligent manufacturing

Discrete manufacturing | Consumer goods | Process manufacturing | Pharmaceuticals | Energy | Automotive | Aerospace

Transform your workforce |
Engage customers in new ways |
Build Agile Plants |
Create more resilient supply chains |
Unlock innovation and deliver new services

Reskill Workforce and Boost Productivity |
Customer Signals and Omnichannel |
Optimize Production and Assets |
Intelligent Supply Chain |
Digital Thread, Simulation and Sustainable New Business Models

Manufacturing a resilient and sustainable future
Microsoft’s perspective for Building Agile Plants

**Innovative Capabilities**
- Operational visibility
- Connected operations
- Intelligent supply chain
- Workforce transformation
- Sustainability

**Customer outcomes**

- **Unilever**: Develop insights to help operators make better decisions using digital twins of the factory
- **Jabil**: Reduced scrap & rework by 17% and energy usage by 10%
- **Caterpillar**: Reduced parts inventory costs by 10-15% using integrated business planning
- **thyssenkrupp**: Use technology to attract, train, and keep your next workforce safe
- **Ecolab**: Eliminate waste and engineer better outcomes for all your stakeholders
Our experience shows that implementation of agile factories/plants typically occurs in three phases:

Even if the end goal is autonomous operations the first step is to get connected and build a consistent data foundation.

Phase 1: Connected
- Devices/PLCs/IPCs
  - Define data and sources
- Edge gateways
  - Get plugged-in
- Telemetry dashboards
  - See what is happening

Phase 2: Predictive
- Time-series/historical data, Hierarchical data modeling
  - Understanding causes & impacts
- AI models, machine learning
  - Predicting what will happen

Phase 3: Assisted & Autonomous Operations Self-Healing
- Digital feedback loops, method calls
  - Self-optimizing response
- “Pay-as-you-go”, outcome-based products
  - New services & business models
100% AUTOMATED, REAL-TIME INDUSTRIAL INSPECTION

SPYGLASS VISUAL INSPECTION

Manufacturing Defect Detection & Elimination
THE PROBLEM

AUTOMOTIVE MANUFACTURERS SPEND AS MUCH AS 40% OF THEIR ANNUAL REVENUE PRODUCING DEFECTIVE PRODUCTS

-- International Journal of Quality Engineering and Technology
Internal Attempts to Control Costs of Quality

- Hire extra QA personnel
- Slow line speeds down
- Put machine vision systems in place
Traditional Machine Vision Systems

• Work well on clear-cut problems
• Don’t work so well on “fuzzy” problems
• Prone to over-tightening to avoid fuzzy problems
3 REASONS TO BRING AI TO YOUR FACTORY FLOOR

INDUSTRY 4.0

Many manufacturers are hungry to adopt IoT & machine learning as a portion of their Industry 4.0 transformation. Those who do will outperform those who don’t.

68% TOP PRIORITY

In a recent McKinsey survey, 68% of manufacturers report that incorporating Industry 4.0 technology, specifically AI, is their top priority – which leaves 32% of companies at risk of being left behind.

72% NOT AT SCALE YET

Only 28% of manufacturers have implemented Industry 4.0 at scale, while 42% are conducting PoCs & pilots. Again, 30% have yet to begin the journey and risk being left behind.
“By employing advanced image recognition techniques for visual inspection and fault detection, productivity increases of up to 50% are possible.

Specifically, AI-based visual inspection that’s based on image recognition may increase defect detection rates by up to 90% as compared to human inspection.”

-- McKinsey
Question: Which of these images of fabric show a defect?
Answer: Which of these images of fabric show a defect?
Congratulations!

You’re now trained at telling lint from stains!
What does your organization call a false positive in its defect detection process?
SPYGLASS VISUAL INSPECTION

A subscription-based product that reduces manufacturers’ cost of quality by leveraging Deep Learning, IoT, and the Cloud to detect and reduce defects

• Reduces false positives
• Reduces or eliminates human inspection
• Improves throughput
• Reduces defects
HOW SVI DELIVERS VALUE

Factory Floor / Cameras

**Industrial Vision System**
Edge is performing defect detection and classification and communicating with cloud decision making

Factory
Business as usual - no changes. Signals alert a defect, and action can be taken

Images and Metadata

Images and Metadata

Control Signals
Modbus / Profinet / DeviceNet / Ethernet / IP

Factory

**Diversion Gates**

**Pick-and-Place Robots**

**The Edge**
Defect detection & classification, sends metadata to cloud

**Human Machine Interface**

**ML Model + Deployment Code**

**Azure IoT Edge**

Local Data Storage

Local GPU Compute

**On-premises**

Edge Intelligence Server

**Azure Cloud**

Reporting and Data (MQTT)

Azure IoT Hub

Azure SQL + Blob

Cloud Storage

Model Management

Model Training

PyTorch

Data Labeling

Cloud

Power BI

Dashboards

Monitoring and Alerting

MARINER
THE CLOUD IS HOW WE ELIMINATE DEFECTS

SPYGLASS VISUAL INSPECTION - WHAT’S UNDER THE HOOD

LOT OVERVIEW

LOT Detail

LOM0840_02
Production SVI In-Factory App Presents Detailed Deep Learning Model Results

Overall Result: Fail

Shape & Breakage: No Decision Rules
In-factory applications allows users to tag images to improve Deep Learning model performance over time.
### Normal Inspection Settings

<table>
<thead>
<tr>
<th>Defect</th>
<th>Max Size (mm)</th>
<th>Min Confidence</th>
<th>Reject</th>
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<tbody>
<tr>
<td>Edge Chip</td>
<td>2</td>
<td>55</td>
<td>✔</td>
</tr>
<tr>
<td>Scratch</td>
<td>15</td>
<td>60</td>
<td>✔</td>
</tr>
<tr>
<td>Ad Chip</td>
<td>2</td>
<td>65</td>
<td>✔</td>
</tr>
<tr>
<td>Rolled Edge</td>
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<td>90</td>
<td>✔</td>
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</table>

### Modified Inspection Zone

<table>
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<th>Defect</th>
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<th>Reject</th>
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</thead>
<tbody>
<tr>
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</table>
AUTOMOTIVE GLASS CASE STUDY

• The Client
Global glass manufacturer with a large automotive glass business in the Americas and Europe

• The Problem
Our customer had a 25% false reject rate with their existing machine vision system. Human oversight of existing machine vision system required slowing production lines by 15% - 20%.

• The Results
  • Earning ~$4m in ROI annually
  • Reduced false reject rate to <1%
  • Operate production lines at 100% speeds
  • Rolling out to factories in Ohio, North Carolina, and Poland
AUTOMOTIVE FABRIC CASE STUDY

• The Client
Global manufacturer of automotive fabric that provides body cloth and headliner to major OEMs worldwide

• The Problem
• 34% false reject rate with their existing machine vision system
• Line speeds at 35% of capacity
• 4 Inspectors at end of line

• The Result
• Earning ~$2m in ROI annually
• Reduced false reject rate to <2%
• Operate without human inspection
• Rolling out to more factories
HOW TO GET STARTED

RISK-FREE 30-DAY PROOF OF VALUE ENGAGEMENT

Prerequisite: Verification of Significant Business Impact with Business Decision Maker

Capture Images
Using either your vision controller or our loaner image formation kit, begin capturing images of your products to be labeled

Label Images
Using these images, your quality personnel identify and classify defects in the images

Build Vision Model
Mariner data scientists create a vision model using your captured and labeled images

Present Results
Mariner presents the results from vision modeling to determine if the conditions of satisfaction are met

Achieve Success Criteria?

Yes
Move Forward

No

www.mariner-usa.com/proof-of-value-offer
LET’S GET STARTED

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Request Your Proof of Value at
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