



# Fewer Defects, Faster Speed

Spyglass Visual Inspection for Manufacturers



MARINER

# Agenda

---

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



A woman in a blue shirt and jeans is walking through a modern industrial facility. She is carrying a white folder or tablet. The facility features large blue cylindrical tanks supported by blue stands, with various pipes and valves. The floor is light-colored and has yellow safety markings. The background shows more industrial equipment and a clean, well-lit environment.

# Building Agile Plants – Optimize Production and Assets

Adam Juechter, Global Black Belt, Azure IOT



# Microsoft framework for intelligent manufacturing

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

Transform your  
workforce



Reskill Workforce and  
Boost Productivity

Engage customers  
in new ways



Customer Signals and  
Omnichannel

Build Agile Plants



Optimize Production and  
Assets

Create more resilient  
supply chains



Intelligent Supply Chain

Unlock innovation and  
deliver new services



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

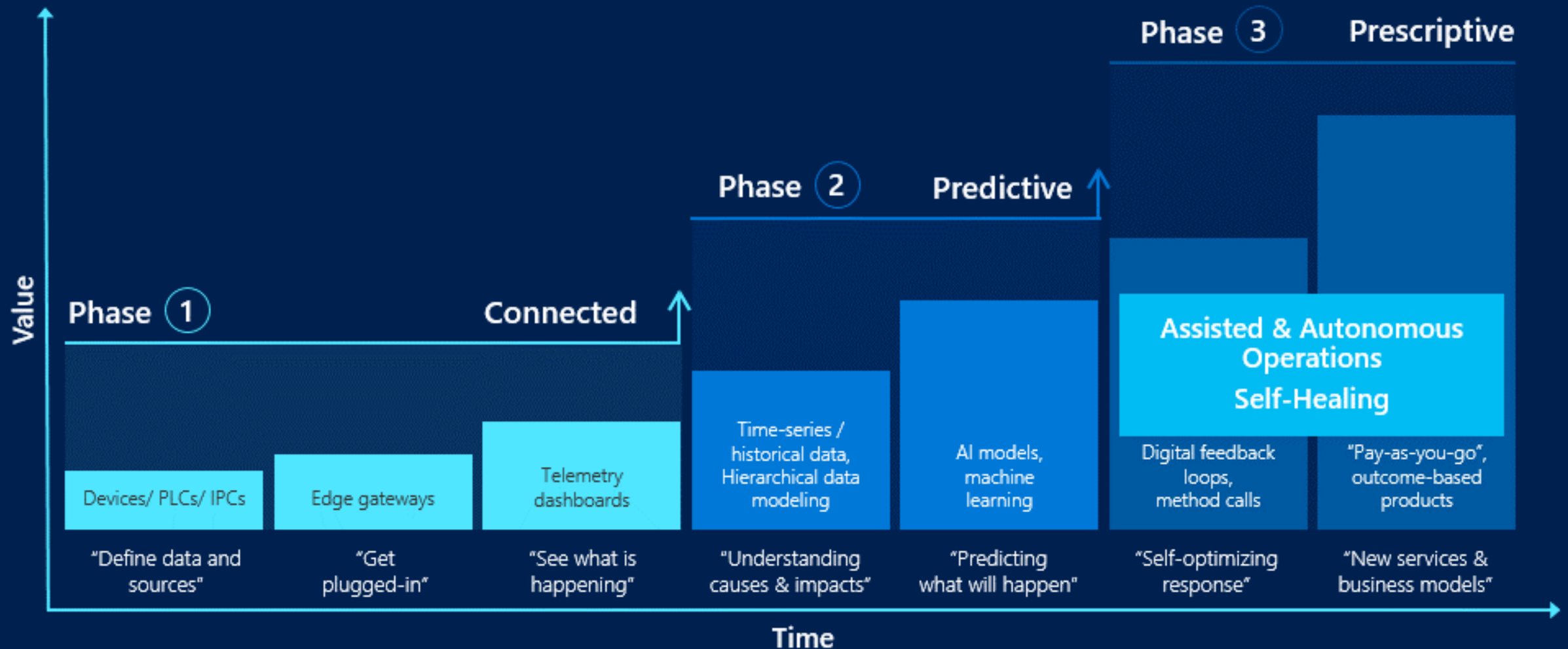


## Customer outcomes

	Develop insights to help operators make better decisions using digital twins of the factory
<b>JABIL</b>	Reduced scrap & rework by 17% and energy usage by 10%
<b>CATERPILLAR</b>	Reduced parts inventory costs by 10-15% using integrated business planning
	Use technology to attract, train, and keep your next workforce safe
<b>ECOLAB</b>	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







# MARINER

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*

MARINER





# 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.

”



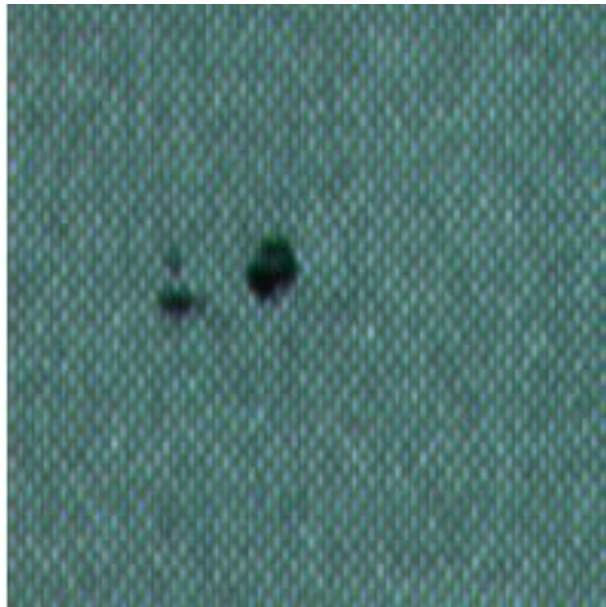
Question: Which of these images of fabric show a defect?



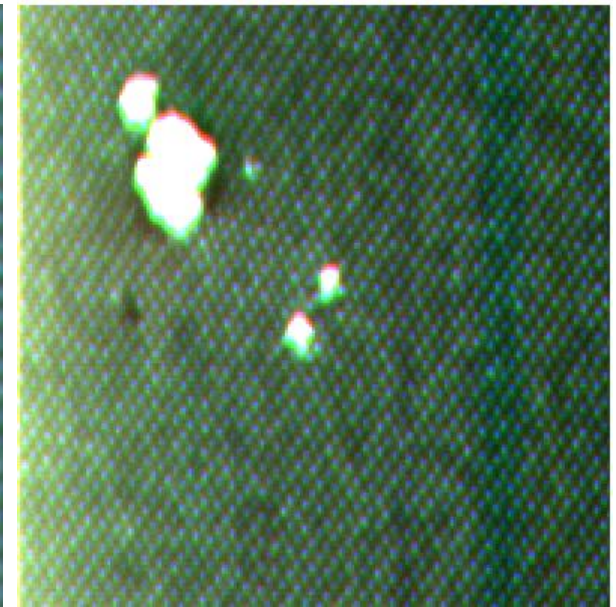
1



2



3



4

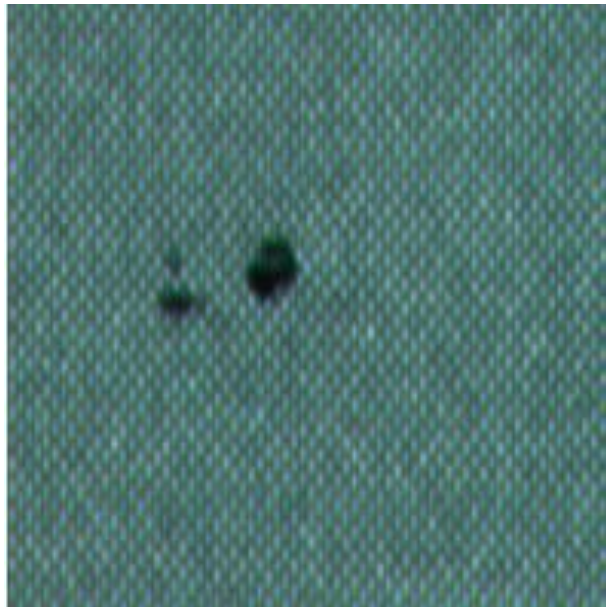
Answer: Which of these images of fabric show a defect?



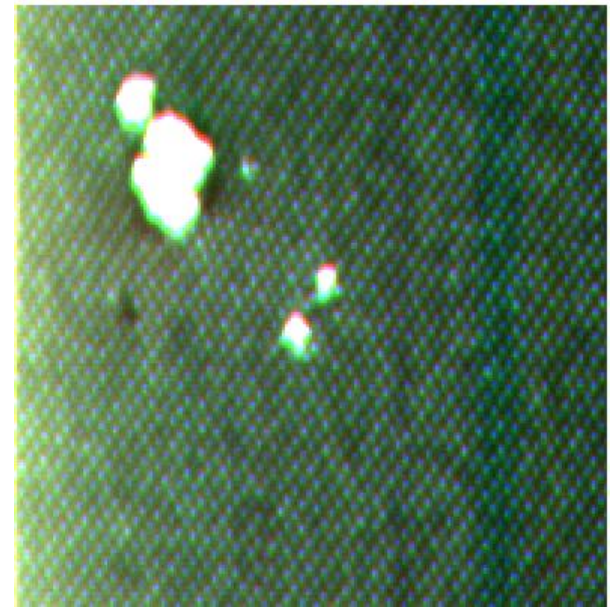
1



2



3



4



# Congratulations!

---



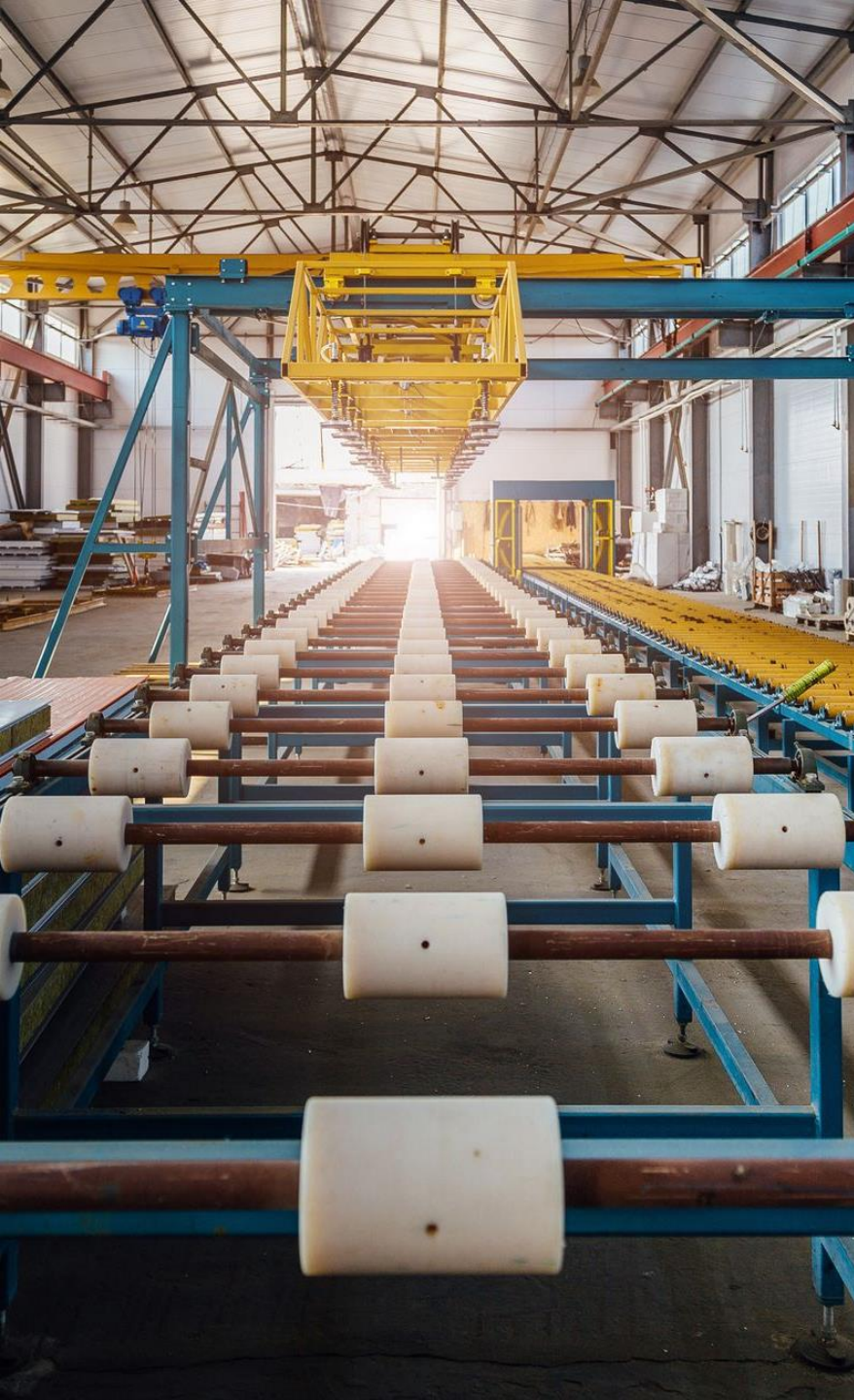
You're now trained at telling lint from stains!

# Question

---

What does your organization call a false positive in its defect detection process?

— \\_ (ツ) \\_ /



# SPYGLASS VISUAL INSPECTION

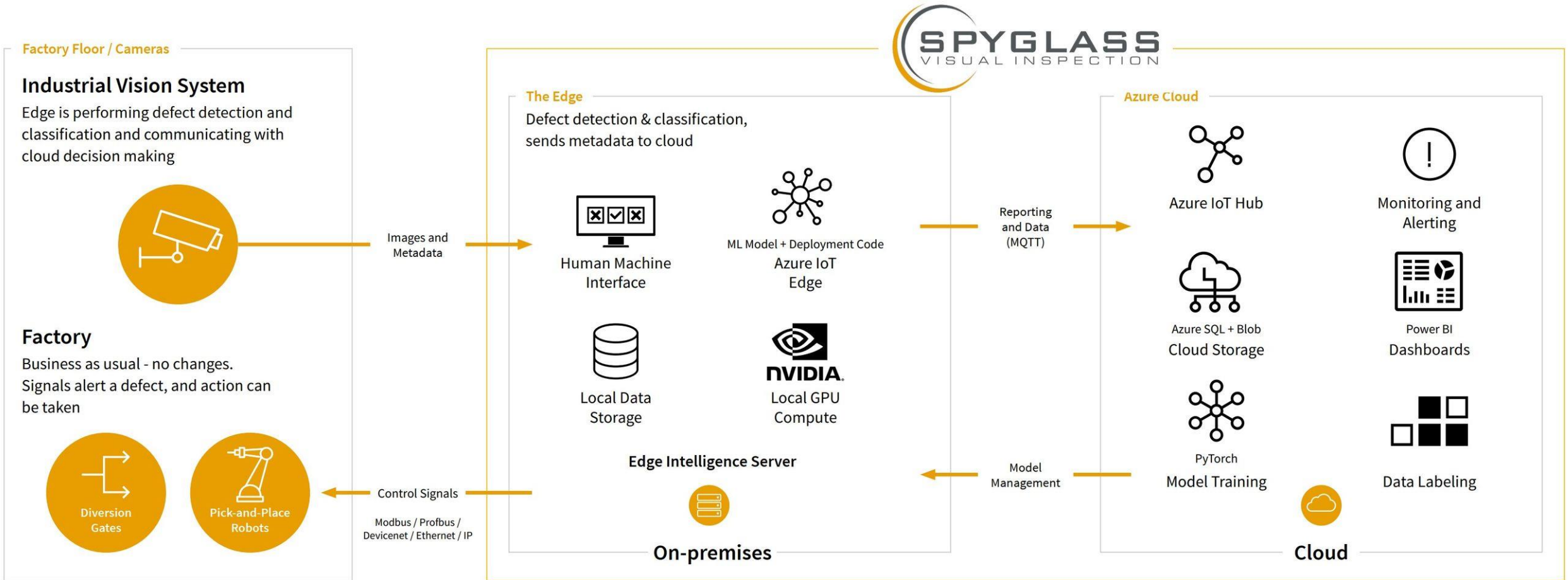
A subscription-based product that reduces manufacturers' cost of quality by leveraging Deep Learning, IoT, and the Cloud to detect and reduce defects

- Reduces false positives
- Reduces or eliminates human inspection
- Improves throughput
- Reduces defects





# HOW SVI DELIVERS VALUE



# THE CLOUD IS HOW WE ELIMINATE DEFECTS

### LOT OVERVIEW

lot	end_time	fabric_type	evs_style	length	Defects/100 yds	False/100 yds	Style
2302351_01	1/4/2021 9:54:46 AM	Bodycloth	Lyric7406	930.10	5.70	24.62	
2302351_02	1/4/2021 9:54:46 AM	Bodycloth	Lyric7406	930.10	14.94	27.63	
2302349_01	1/4/2021 9:34:02 AM	Bodycloth	Lyric7406	959.40	3.23	23.45	
2302349_02	1/4/2021 9:34:02 AM	Bodycloth	Lyric7406	959.40	5.73	27.31	
2302319	1/4/2021 9:12:53 AM	Headliner	HL-Light	930.70	8.49	23.64	LYRIC - MOTU
2302320	1/4/2021 9:12:53 AM	Headliner	HL-Light	930.70	11.93	25.14	LYRIC - MOTU
2302317	1/4/2021 8:52:10 AM	Headliner	HL-Light	1,008.50	1.69	12.20	LYRIC - MOTU
2302318	1/4/2021 8:52:10 AM	Headliner	HL-Light	1,008.50	5.45	20.33	LYRIC - MOTU
2302313_01	1/4/2021 8:30:06 AM	Bodycloth	2P-D	3,044.99	0.56	3.25	
2302313_02	1/4/2021 8:30:06 AM	Bodycloth	2P-D	3,044.99	0.99	3.19	
2302315_01	1/4/2021 8:09:39 AM	Bodycloth	2P-D	2,106.29	1.57	7.79	
2302315_02	1/4/2021 8:09:39 AM	Bodycloth	2P-D	2,106.29	2.90	7.74	
2302373	1/4/2021 7:44:58 AM	Headliner	HL-Light	972.10	4.73	12.04	ON TRICOT
2302374	1/4/2021 7:44:58 AM	Headliner	HL-Light	972.10	4.22	7.72	ON TRICOT
2302371	1/4/2021 7:19:31 AM	Headliner	HL-Light	907.50	3.09	10.69	ON TRICOT
2302372	1/4/2021 7:19:31 AM	Headliner	HL-Light	907.50	3.75	11.02	ON TRICOT
2302391_01	1/4/2021 5:54:58 AM	Bodycloth	6200_Gray	1,035.50	13.13	35.64	

11/3/2020 1/4/2021

Class

- Select all
- Bar\_Holes
- Camera\_Error
- End\_Out
- Hole
- Miss\_Pin
- Not\_Enough\_Poi...
- Pulling\_Ends
- Seam
- Snags

evs\_style: All Machine: All lot: All

fabric\_type: All StyleName: All filename: All

PieceNumber: All SetNumber: All Cut: 0 1042

Stop\_Marks

- Stain
- Not\_Enou...
- Unknown
- Camera\_Er...
- Yarn\_Flash
- Seam
- End\_Out
- Bar\_Holes
- Snags
- Hole

Defects/100 yds

False/100 yds

### LOT Detail

Lot Lookup: 2300840\_02

prediction

- Select all
- Bar\_Holes
- False
- Flock
- Snags
- Stain
- Stop\_Marks
- Unknown

7.49 25.87

Defects/100 yds False/100 yds

12/23/2020 9:58:17 AM

End Time

y\_position: 2.54, 4,627.65

2300840\_02

Y Pos	Prediction	Length	Confidence	Images	ID
6.47	Bar_Holes	0.00	0.97	1	2
25.90	Bar_Holes	8.06	0.74	3	15
41.40	Unknown	0.00	0.45	1	22
42.48	Bar_Holes	0.00	0.99	1	24
55.00	Bar_Holes	0.00	0.54	1	31
62.82	Bar_Holes	5.10	0.92	5	33
75.13	Unknown	0.00	0.43	1	38
85.35	Bar_Holes	16.85	0.92	12	41
112.20	Bar_Holes	3.47	0.65	3	50
123.00	Bar_Holes	0.27	0.82	2	53
132.10	Unknown	0.01	0.46	1	55
132.16	Stop_Marks	0.09	1.00	24	56
132.21	Snags	0.02	0.56	1	57
132.25	Unknown	0.00	0.47	1	58
144.00	Unknown	0.00	0.48	1	61
173.09	Stop_Marks	0.07	1.00	15	70
197.66	Unknown	0.00	0.43	1	75
235.52	Stain	0.00	0.85	1	83
251.32	Bar_Holes	0.00	0.98	1	85
257.69	Bar_Holes	3.63	0.62	2	89
270.84	Bar_Holes	10.83	0.88	5	94
287.69	Bar_Holes	0.00	1.00	1	98
303.21	Bar_Holes	11.32	0.78	4	102
342.99	Bar_Holes	6.22	0.88	3	115
354.94	Bar_Holes	0.02	1.00	2	122
359.90	Unknown	0.59	0.48	2	123
361.08	Bar_Holes	4.81	0.84	5	124
366.24	Unknown	0.00	0.41	1	126
377.83	Bar_Holes	0.00	0.96	1	130
384.44	Unknown	0.00	0.45	1	133
392.94	Unknown	0.00	0.42	1	135
398.08	Bar_Holes	0.00	0.99	1	137
424.47	Bar_Holes	8.01	0.97	5	143

Bar\_Holes

Unknown

Stop\_M...


Snags

Stain

Prediction Frequency

Bar_Holes	19
Unknown	10
Stop_Marks	2
Snags	1
Stain	1
<b>Total</b>	<b>33</b>

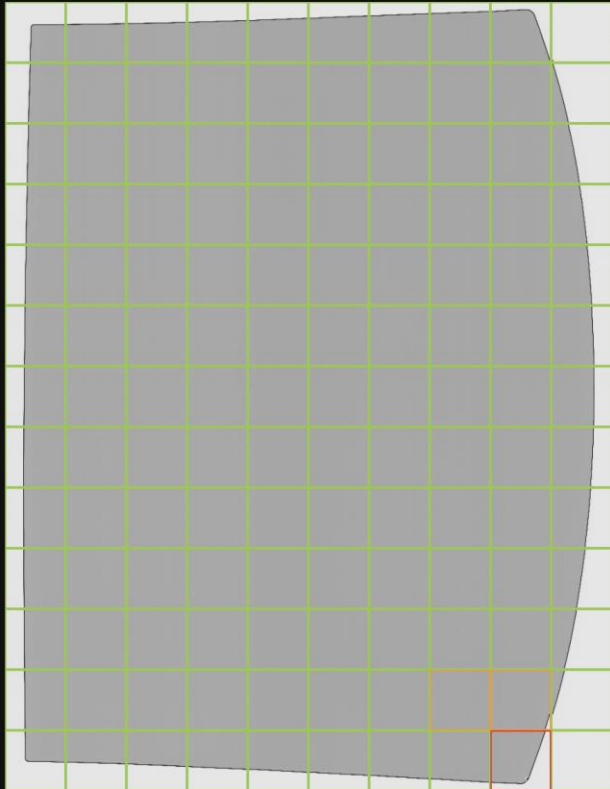
# Production SVI In-Factory App Presents Detailed Deep Learning Model Results



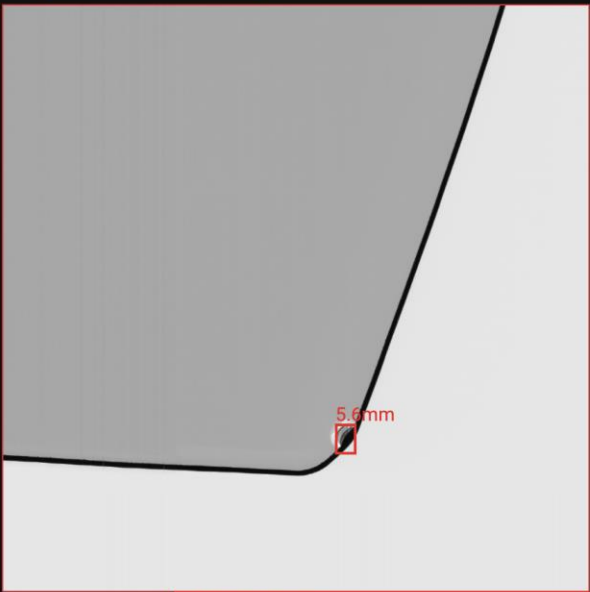
Watch folder  Connect

Machine 4220c5f14388    Model 2020-09-22-11-27-41 (ac...)

4254 2019-04-23 08h36 pre    October 4 9:01:5555  
(212,228-7523,10115)



Edge Chip
Dirt



**EDGE CHIP**
Confidence: 98%

Timestamp	Result	Confidence	
9:05:5555			
Oct 4 9:05:4646	Edge Chip	94%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:04:5656	Water	91%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:04:3535	Ad Chip	58%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:03:5757	Rolled Edge	97%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:03:1919	Scratch	43%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:5858	Ad Chip	78%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:5252	Scratch	90%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:4343	Ad Chip	74%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:2121	Good	41%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:1212	Good	42%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:02:044	Water	94%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:01:5555	Edge Chip	98%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>
Oct 4 9:01:4343	Edge Chip	98%	<span style="border: 1px solid gray; padding: 2px;">Tag</span>

[Load More](#)

Overall Result

FAIL

Shape & Breakage

No Decision Rules



# In-factory applications allows users to tag images to improve Deep Learning model performance over time

SPYGLASS  
VISUAL INSPECTION

Watch folder

Machine 4220c5f14388 Model 2020-09-22-11-27-41 (ac...)

4578 2018-11-29 07h05 pre October 4 9:07:5656  
(2180,276-7123,4659)

Good Good

Timestamp Result Confidence

Oct 4 9:08:011	Edge Chip	97%	<input type="button" value="Tag"/>
Oct 4 9:07:5656	Good	76%	<input type="button" value="Tag"/>
Oct 4 9:07:5050	Good	60%	<input type="button" value="Tag"/>
Oct 4 9:07:1818	Water	61%	<input type="button" value="Tag"/>
Oct 4 9:06:4747	Edge Chip	45%	<input type="button" value="Tag"/>
Oct 4 9:06:4242	Good	62%	<input type="button" value="Tag"/>
Oct 4 9:06:3636	Good	61%	<input type="button" value="Tag"/>
Oct 4 9:06:3131	Good	75%	<input type="button" value="Tag"/>
Oct 4 9:06:2626	Good	81%	<input type="button" value="Tag"/>
Oct 4 9:06:2020	Water	95%	<input type="button" value="Tag"/>
Oct 4 9:05:5555	Edge Chip	59%	<input type="button" value="Tag"/>
Oct 4 9:05:4646	Edge Chip	94%	<input type="button" value="Tag"/>
Oct 4 9:04:5656	Water	91%	<input type="button" value="Tag"/>
Oct 4 9:04:3535	Ad Chip	58%	<input type="button" value="Tag"/>
Oct 4			<input type="button" value="Tag"/>

AD Confidence: 76%

Shape & Breakage


- ✓ Shape Score: 99.74%
- ✓ Edge Score: 77.47%
- ✓ Hole Score: 92.08%
- ✓ Hole Count: 1

PASS

Add Tag

- Ad Chip
- Dirt
- Dust
- Edge Chip
- Good
- Rolled Edge

# Decision Rules UI Allows for Precise Control of Deep Learning Decisioning Criteria



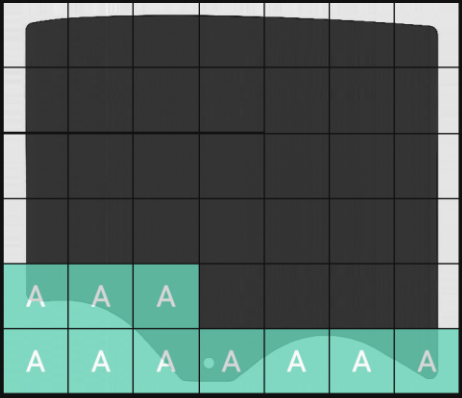
Watch folder

Machine 4220c5f14388 Model 2020-09-22-11-27-41 (ac...)

## Decision Rules

Recipe: My Recipe (active)  Activated

### Reference Image



### Zone Settings

#### Normal Inspection Settings

Defect	Max Size (mm)	Min Confidence	Reject
Edge Chip	2	55	✓
Scratch	15	60	✓
Ad Chip	2	65	✓
Rolled Edge	10	90	✓

#### Modified Inspection Zone **A**

Defect	Max Size (mm)	Min Confidence	Reject
Edge Chip	5	55	✓
Scratch	15	60	✓
Ad Chip	2	65	✓
Rolled Edge	10	90	✓

### Recipe Rules

#### Shape Check ⓘ

Enabled Threshold **98** %

#### Edge Check ⓘ

Enabled Threshold **0** %

#### Hole Check ⓘ

Enabled Threshold **0** %

#### Hole Count ⓘ

Enabled

# 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

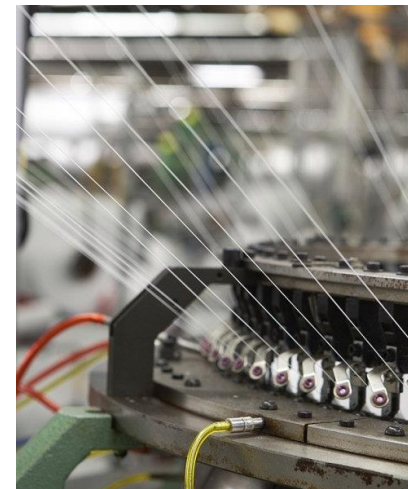
Global manufacturer of automotive fabric that provides body cloth and headliner to major OEMs worldwide

- 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

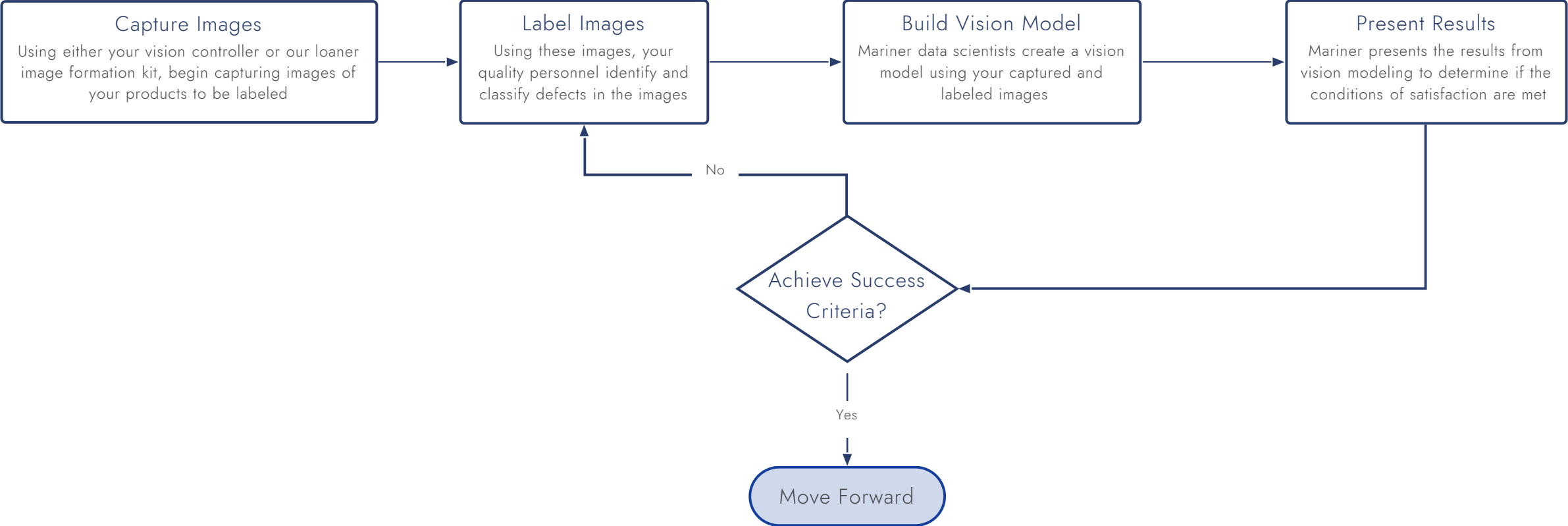
- Earning ~\$2m in ROI annually
- Reduced false reject rate to <2%
- Operate without human inspection
- Rolling out to more factories



HOW TO GET STARTED

# RISK-FREE 30-DAY PROOF OF VALUE ENGAGEMENT

Prerequisite: Verification of Significant Business Impact with Business Decision Maker





# LET'S GET STARTED

Contact Us:



[www.mariner-usa.com](http://www.mariner-usa.com)



+1 (704) 540-9500



[info@mariner-usa.com](mailto:info@mariner-usa.com)

Request Your Proof of Value at  
[www.mariner-usa.com/proof-of-value-offer](http://www.mariner-usa.com/proof-of-value-offer)