

# Intelligent Inspection with AI.

AUTOMATED INSPECTION MACHINES POWERED BY DEEP LEARNING.

## VALIDATED

- System ready for qualification
- Already in use in manufacturing line

## SIMPLE

- Seamless integration into vision system
- Only 3 vision tools per recipe

## EFFECTIVE

- Detection rates up to 100%
- False reject rates down to 0%

## ECONOMICAL

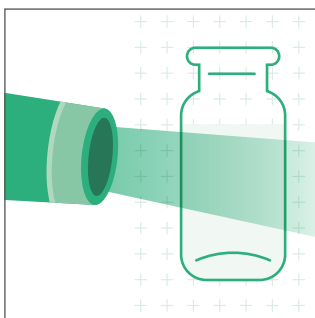
- Less machine idle time for recipe tuning
- Potentially millions of dollars in annual savings

## THE FUTURE IS HERE

Syntegon Technology stands one step ahead as the leader in developing and successfully validating Artificial Intelligent (AI) technology for image processing in automated inspection machines. The new vision system excels in detection of particulates and cosmetic defects using Artificial Neural Network (ANN) algorithms, configured and optimized with Deep Learning (DL) methodology.

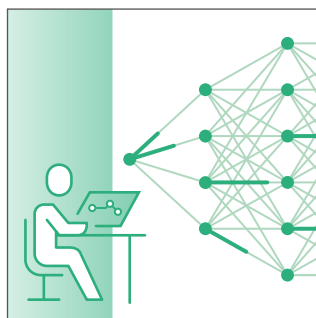
A dramatic decrease in false rejection of conformant products and increase in true detection of defective containers is achieved simultaneously through the vision software, without compromising any other aspects of machine performance such as processing times or container handling.

### ACQUIRE PRODUCT IMAGES



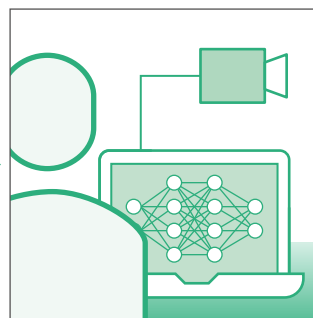
- IMAGE CLASSIFICATION
- IMAGE ANALYSIS

### TRAIN NEURAL NETWORK



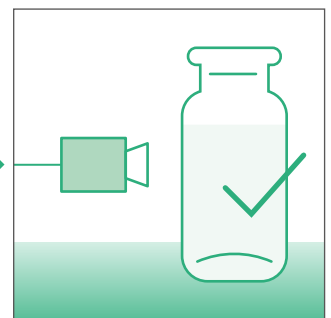
- DEEP LEARNING MODEL
- EASY USE SOFTWARE

### IMPORT TO VISION RECIPE



- SEAMLESS INTEGRATION
- ONLY 3 VISION TOOLS

### INTELLIGENT INSPECTION WITH AI



- IMPROVED DETECTION
- REDUCED/ELIMINATED FALSE REJECTS

## Economic benefits

A case study for a mix of 3 biotech products and assumed costs of sold product as 14% of market value, indicates an ROI of only 2 months. False rejects were reduced down to the values as a result of Syntegon's AI technology, which created large cost savings

for product re-inspection. Extreme simplification of the vision recipe means shorter machine downtime for product setup. The capability of one DL tool to be applied for a collection of product types reduces the time needed for recipe development providing major cost saving.

# Sample Cases.

## Particles in high viscous solution with bubbles

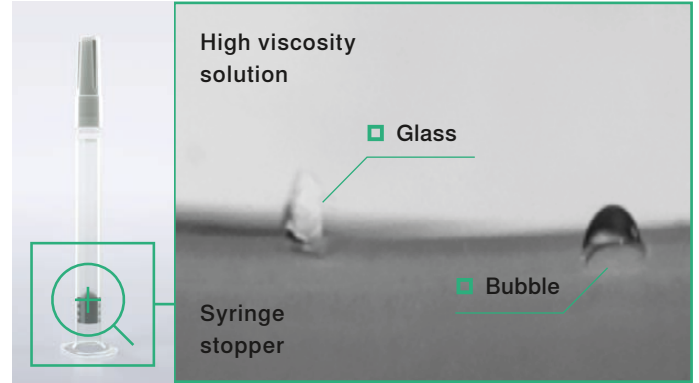
### Prefilled syringe, high viscosity product

Glass, metal shards, rubber and plastic particulates are targets for detection. In this challenging application, bubbles cannot be removed by container spinning, and inspection with standard image processing caused high false rejects of acceptable containers.

Machine retrofitting with the new AI inspection technology gave outstanding improvement:

- ❑ Increase in detection by 1.7 times
- ❑ Decrease of false rejects to less than half

Sample Case 1



## Particles in Lyophilized cake

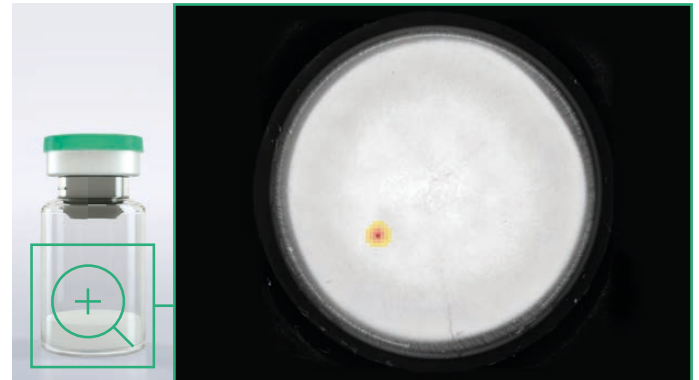
### Lyophilized product in vials, cake with cracks

Tiny particles at the cake bottom appear similar to crack features. Inspection by standard image processing requires 20+ vision tools and, still, accurate inspection is challenging.

With AI, excellent results were obtained:

- ❑ 100% detection efficacy
- ❑ 0% false rejects

Sample Case 2



Confusion Matrix		DL Inference					
		Good	Black Particle	Broken	Empty	Particle	White Particle
Label	Good	28	0	0	0	0	0
	Black Particle	0	109	0	0	1	0
	Broken	0	0	13	0	0	0
	Empty	0	0	0	98	0	0
	Particle	0	0	0	0	22	0
	White Particle	0	0	0	0	0	8

### Operational benefits

- ❑ Seamless AI integration into vision software
- ❑ User-friendly and intuitive training of the Artificial Neural Network with Syntegon's original software
- ❑ Clear visualization of the Deep Learning model creation and optimization process
- ❑ Enabling data analytics for process improvement
- ❑ Vision recipes extremely simplified down to only 3 vision tools: image crop, classification by DL, prediction judge

Syntegon Technology GmbH

Phone +49(7151)14-2489  
 Mail packaging-ph@syntegon.com  
 Web www.syntegon.com

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