# Automatic Inspection by Deep Learning

Deep learning enables automation of inspection tasks that are too complex for machine vision. Bi-Ber has implemented a visual product inspection solution for a manufacturer of fine chocolate and waffle products, using deep learning. The sweets are rectangular or round, they come in different sizes and are coated with chocolates with different cocoa contents. The products are checked when still in the mould.

The inspection system must generate a Pass or Fail signal for each cavity. Depending on the mould, the inspection system must segment and evaluate up to 108 AOI per mould. There must be no plastic or metal pieces, incomplete coatings, billowing fillings, or breakage. Less critical optical flaws such as uneven coatings should ideally also be detected, but tolerances for these can be adjusted.
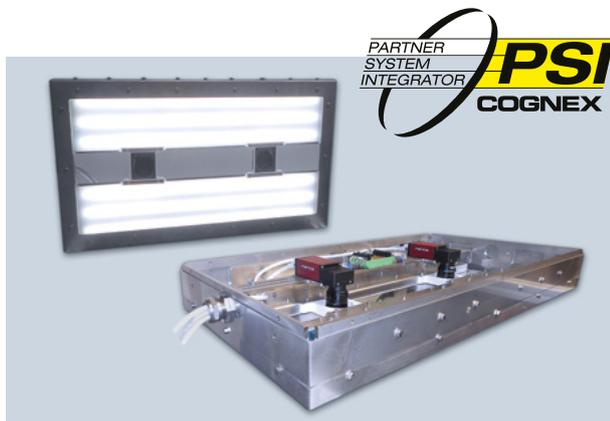

Housing and view from below

Neural network checks quality in chocolate production

Introducing AI-based automatic quality inspection, the manufacturer wanted to eliminate manual visual inspection and increase detection reliability. Final inspection of chocolates is particularly challenging for image processing systems because of the products' non-uniform look. Errors also vary slightly in appearance, unknown types of errors are added.

Conventional machine vision is based on an exact description of the defect's appearance. Such fixed rules cannot be defined for this inspection task, unless with substantial programming effort. In deep learning, on the other hand, artificial neural networks fed with sample images formulate their own criteria for categorising images. Notably, there can be a large variance between product images that are rated as good – many optical deviations are permissible and are not considered errors.
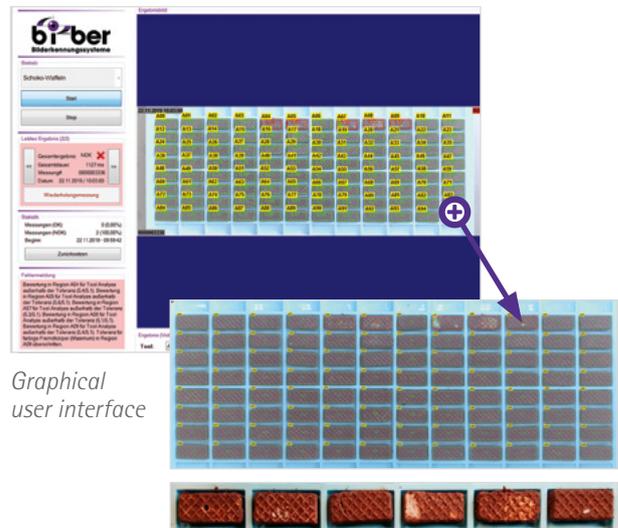
Graphical user interface

Result image of a mould with row detail

Quick training – fast evaluation

The deep learning application uses Cognex VisionPro ViDi, specifically the ViDi RED Analyze tool for segmentation and error detection. Not only good and bad images are marked, but also the errors in the images in order to focus the AI on the specified flaws ("Supervised Learning"). ViDi does not require huge image data sets and thus saves a lot of time when teaching. The AI assigns a quality coefficient to each area of interest (AOI). The user can set the tolerance limit according to these values, actively deciding how homogeneous the products must be and which reject rate is acceptable.

ViDi training interface

Compact system hardware

The inspection system hardware is based on successful past machine vision projects of Bi-Ber in the confectionery industry: it features GigE cameras, a low height, a protective window to shield off the product area, stainless steel housings, and a touchscreen panel outside the product area.