

QZ Qualität und Zuverlässigkeit

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Perfected value chains

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Perfected value chains

Integrated AI with anomaly detection

In Industry 4.0, with continuously automated value chains, vision systems are central elements. Integrated AI technology with anomaly detection takes fault detection to a higher level. With almost absolute certainty, defective parts can be recognised and removed very early.

Kamillo Weiß

Neural-network-based AI technologies are permeating the entire range of machine vision in industry and many other fields. They have become an enormous driver of innovation throughout automation. Across the complete value chain in manufacturing, widely differing products have to be inspected, identified and classified continuously, with defective parts rejected. This is integrated seamlessly into automation as a logical part of Industry 4.0 digital continuity and also places extra demands on quality assurance.

Deep-learning AI functions are now decisive contributors to much more reliable, robust feature detection. Further benefits include accelerating the development of complex vision-system solutions and their integration into the automation process.

In conventional rule-based machine vision, the images of objects under inspection are continuously compared with the target condition. Conditions defining a defect are specified and the faulty object is rejected. Deep learning is based on the architecture of artificial neural networks (CNNs). Captured image data is evaluated extensively, digitally labelled with properties and can recognise new fault types through deep-learning-based training. A problem in the past was often insufficient numbers of bad images: hundreds to thousands were needed for this deep learning. Newly powerful AI functions in vision software and intelligent LED lighting technology now reduce this to, for example, 50 to 200 training images per fault type. Demanding applications with high image resolution and fast cycles, in

synergy with deep learning, require very high computing performance with appropriate CPUs, GPUs and other accelerators. For complex tasks involving several high-resolution cameras, industrial high-performance PCs are advantageous, because they handle Industry 4.0 communication as well as vision processing.

Detection using good images

For users of AI vision solutions, easily accessible via graphically parameterised touchscreen programming, anomaly-detection technology offers a powerful range of functions in machine-vision software. Strong AI algorithms are used, standardised and supported worldwide.

A component in an absolutely flawless condition, a so-called

good image, can for example be an entirely defect-free small glass container from the pharmaceutical industry. Such good images can now be generated quickly, easily and at low cost. Suitable AI detection results require only 20 to 100 training images. Defects do not necessarily need to be known beforehand. Anomaly detection discovers and localises defects in training: cracks, notches, foreign bodies and surface contamination. Segmentation can then be used to measure the detected defects in pixels and locate them.

In real industrial environments, conditions and disturbances such as daylight, lighting, reflections and other factors often change. AI systems can respond to altered conditions by self-learning and build tolerance to such interference. Environmentally protected enclosures around vision systems can therefore be simplified, made smaller or eliminated in the automation process.

QBIC: versatility in a strong team

Fully automated complete vision solutions based on connected QBIC modules cover a broad range of applications in many industries. Equipped with high-performance industrial PCs, they are suitable for pick-and-place, registration and classification, ID codes,



Figure | HALCON anomaly-detection technology with self-learning detects defects in the bottle neck. © Cretec / MVTec

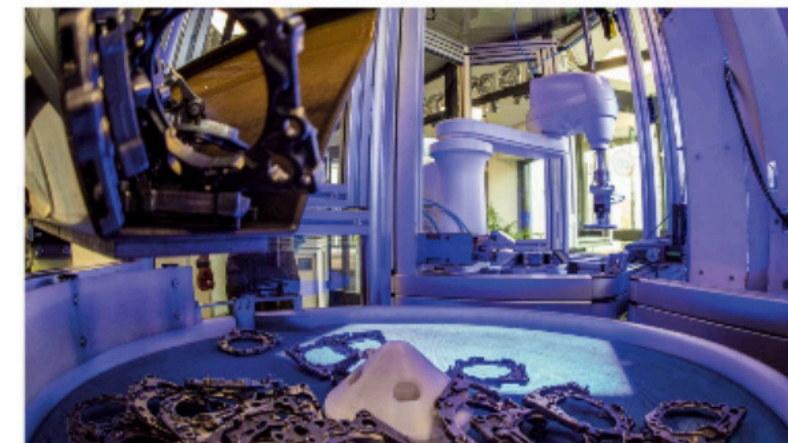


Figure 1 | Parts fall from the feeder onto the shaker disc of the QBIC FlexiBowl. They are reliably separated, located by machine vision and gripped precisely by the robot, which presents them to the second 2D and 3D vision system. © Cretec GmbH

inspections in 2D and 3D, measurements and many combinations of these tasks. The modular system offers many advantages. Individual QBIC station modules with a wide range of capabilities - encompassing control, data analysis and communication - are connected directly into an autonomous system using Plug & Work. These complete vision solutions are the consistent strategy of a platform with synergy and scalability through logical relationships in networked quality assurance.

Standard vision hardware and software components allow a vision-system solution to be developed quickly, already covering the required tasks in all their complexity at the feasibility-study stage. PCB inspection demonstrates this clearly. Numerous components on the populated PCB must be checked unambiguously for correct positioning and functionality. A high-performance industrial PC and other hardware, with powerful vision software, form the basis of rule-based image processing to ensure each inspection object functions correctly. Detection covers incorrect, missing, incorrectly positioned or defective components, coating material present or partially present, and foreign bodies.

A 60 MP colour camera with a

maximum resolution of 0.026 mm per pixel and a 20 MP black-and-white camera are used. Intelligent LED dome lighting enables different lighting scenarios. The compact QBIC complete inspection solution already includes provision for an extension to 3D inspections. For objects difficult to define reliably and detect, Cretec Vision Algorithms in anomaly detection extend the inspection scope. Deep learning makes it possible to read blurred text that would otherwise go undetected in rule-based machine vision.

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COMPANY

Cretec GmbH and Cretec Cybernetics GmbH in Büdingen (Hesse) develop, manufacture and sell powerful industrial machine-vision solutions, code-reading systems, intelligent LED lighting, cobot/robot vision and integrated artificial-intelligence algorithms.

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