DETECT ANOMALIES SMARTLY

AI-based Smart Cameras

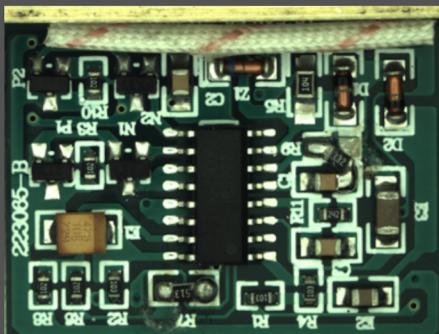Use of AI in electronics manufacturing
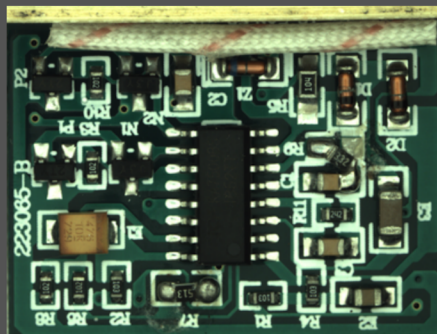

Fig. 1: Defect-free circuit board
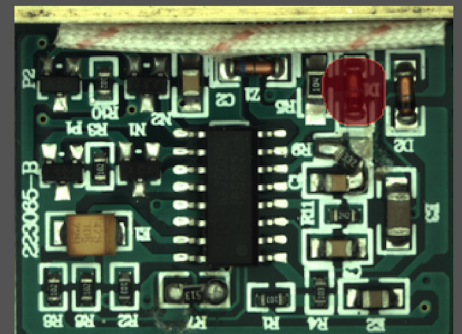
Fig. 2: Circuit board with defective diode

Fig. 3: Anomaly detection marks error

With the flexible, Deep Learning-based image processing system Vision Cam AI.go, IMAGO Technologies enables self-learning processes even for vision devices. Scalable computers and application-optimized AI mathematics are available for more demanding tasks.

The use of artificial intelligence is currently growing strongly in numerous fields of application. In image processing, too, the results of defect analyses with AI support are very promising. However, users face a problem, especially in large-scale production: The production quality is often so high that it can take weeks before sufficiently defective parts are found. Such defective parts, though, are necessary for the learning process of an AI system to generate image classes representing the respective defects.

This can be remedied by AI solutions that detect anomalies, i.e. irregularities, on the produced parts and trigger suitable alarms to eject the faulty parts from the process. This can also detect defects that the user could not have foreseen in advance. Based on the sorted-out parts, further defect analyses are subsequently possible, which contribute to an optimization of the defect detection.

AI made easy

Artificial intelligence methods offer unimagined possibilities, but the technology still has the reputation of being very complex and only controllable by specialists. However, recent advances in hardware as well as application software are creating new options for implementing simple anomaly detection systems. IMAGO Technologies offers a flexible, Deep Learning based image processing system Vision Cam AI.go, a tool suitable for everyday use for this purpose.

Vision Cam AI.go was developed primarily for end users who have little or no experience in program-ming or image processing. The high flexibility of this intelligent camera allows its use in numerous industrial application areas to ensure reliable inspection of quality features and detection of anomalies in the simplest possible way.

Numerous fields of application

The following example from electronics manufacturing the procedure for using Vision Cam AI.go: Here, printed circuit boards are assembled with electronic components in large quantities by machine and then also soldered automatically. Mature assembly and soldering processes usually ensure a very low error rate. Boards classified as defect-free are taught to the vision system used, which enables the AI-based Vision Cam AI.go to subsequently detect products with anomalies and trigger their ejection

The flexible, Deep Learning-based Vision Cam AI.go image processing system enables self-learning processes and the reliable detection of anomalies.

from the process. Employees then decide whether rework of the deviating components is necessary or worthwhile.

Fig. 1 shows a defect-free PCB. Fig. 2 shows a circuit board with a defective diode. The defect is difficult to see with the human eye. In Fig. 3, the defect has been marked by anomaly detection.

Assembled PCBs are often very complex and, due to this, pose a challenge for vision systems. With the help of the Vision Cam AI.go, though, their inspection can be realized without much effort and without the parameterization of complex image processing software. All that is required is the use of lighting that is the most diffuse possible, such as an LED dome, as well as the selection of a suitable C-mount lens and an optional polarization filter to reduce reflections. After mounting the camera, all the user has to do connect the digital I/O to the PLC and the Ethernet to a browser, and the system is ready to go! Anyone familiar with installing and operating a smart camera can easily use the Vision Cam AI.go.

Teach in the camera

In the form factor of a camera, Vision Cam AI.go combines a complete system consisting of a camera sensor with 5 MPixel resolution, a multiprocessor system and easy-to-use application software. After only a few camera settings have been parameterized, the error-free parts can be taught in. This process, which in other systems is often carried out in the cloud, takes place directly in the intelligent IMAGO camera. It has sufficient computing power and is also fast enough for many applications.

This can be well explained using the example of PCB inspection, where three cases can be distinguished: In the first case, one has a restricted "problem zone" on the PCB where defects can occur. If the user defines this region of interest (ROI) and concentrates the inspection on it, the Vision Cam AI.go is fast enough for many applications. If the camera is to calculate on the basis of the 5 MPixel full images in the second case, it needs more time for this. For the usual clock cycles in elec-

tronics manufacturing, Vision Cam AI.go is usually fast enough for this as well.

Scalable solution

If it has to go even faster in the third case, more computing power offers a way out. It is now on the market with the NVIDIA® Jetson Orin™ GPGPU and interfaces required for image processing in the form factor of a box PC and with significantly more AI power. Up to 12 ARM CPU cores and 2048 CUDA processing cores are thus available for the application. The main advantages of such embedded computers compared to an i-Core/GPU variant are significantly lower power consumption with the same performance, which enables a fanless design. The long-term availability of such architectures is another important criterion for users and differs from typical PCIe-GPU cards, which as commercial mass-produced products change at short intervals. PCIe-GPU cards are therefore not suitable for industrial applications due to the difficulty of procuring spare parts and the lack of compatibility of the application software, unlike NVIDIA® Jetson Orin™ modules.

With Vision Cam AI.go, IMAGO Technologies provides users with an easy-to-parameterize AI system to detect anomalies in images and gain hands-on experience with this promising technology. If the technical limits of the hardware or software functionality are reached, the company offers scalable solutions based on application-optimized AI mathematics that are also suitable for more demanding applications such as surface inspection of web goods.