

Imaging Modules and AI

Optical sensors for automatic evaluation of product quality

The 4th Industrial Revolution is characterised by disruption in all business areas and an acceleration of innovation cycles. Will this change the way we do quality assurance today? Will artificial intelligence question existing measurement techniques?

With new methods of big data analysis and the use of deep learning tools as well as advanced data analysis, we will see even more intelligent solutions. It is also possible to greatly improve the actual resolution with structured lighting and other techniques, which makes it possible to achieve larger image fields or better results at the same price. Photometric Stereo Imaging makes it possible to determine the positional accuracy of structures or edges much more accurately and independently of stray light and thus to perform shape and position measurements in the image more accurately and reliably.

Giving the machine eyes

Opto has begun to supply plug-and-play vision sensors to give machines eyes. These Imaging Modules are delivered with camera, optics, and adjusted illumination as well as control electronics, in an adjusted and pre-calibrated package. Aware that there must be several thousand modules if the goal is to deliver a module with the best possible image for each application. As one of the first solutions, a compact all-in-one digital microscope was developed. This has a coaxial and ring light to perform many different tasks with one unit. For brightfield with integrated coaxial EPI illumination to control structures on reflective surfaces and an integrated ring light for darkfield imaging to display impurities and scratches. Together with the profile projector, which like the microscope is equipped with a 5MP Sony sensor and an integrated telecentric imaging and illumination beam path, it is possible to present profiles of needles, nets, screws or other samples in perfect contrast for high-precision measurements.

Ideal for learning

These solutions are suitable for further processing with traditional image processing as they provide optimized contrast and high resolution, optimized for the respective applications. However, the imaging modules are also suitable for learning applications, since the complete structure is built into a compact aluminium housing and cannot be changed subsequently. This enables stable imaging and guarantees the same image quality with the same calibration even with several stations. In order to meet the requirements of factory automation in the course of IoT and Industry 4.0, there will be embedded modules in the future. These will be intelligent order modules that deliver real results and drive machines or deliver direct measurement results. It remains to be seen how intelligent they will be. One way will be the use of structured lighting and the feedback of lighting geometry. The advantage, such as better edge detection, better surface representation of defects and super-resolution evaluation, enable rapid complete statements on shape and position, structure and an integrated, high-resolution defect detection on surfaces.

Quality predictions using deep learning

All this information in one image now enables comparisons and classifications to be used to make a quality statement about the product with high accuracy and repeatability. With Deep Learning you can even make predictions about the quality development of the product - all in real time, because all image-based. These options, coupled with the application-specific imaging modules, could be the disruption that arises in measurement technology.

Nevertheless, it will take some time before these new digital methods become established in quality control, since traceability of the measured values and many existing standards still stand in the way of this. But as already shown in non-industrial markets, such as pathology, digital statements are already being made here that are demonstrably superior to human estimation. Here it is not far away from the AI for quality control.

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