New image-processing methods from Omron

High consumer expectations regarding information on food products, pharmaceuticals and non-food products, as well as new legal requirements, mean that producers have a growing need for inspection solutions that check whether the information has been applied correctly.

In addition to final inspections, producers are increasingly using in-line inspections at critical points in the corresponding processing steps.

Omron Industrial Automation has new image-processing methods in its optimised parallel hardware architecture.

"The key to a faster and more precise optical inspection is in the identification and tracking of the desired image objects," said Victor Marques, Country GM of Omron Electronics, South Africa. "With new image processing algorithms (e.g. edge-based sparse features, variation absorbing templates etc.) and ultra-fast, parallel hardware architecture, the new FH optical inspection system from Omron can achieve detection speeds that are more than 10 times faster than conventional inspection systems. Compared to previous algorithms, it can even achieve 100 times faster speeds while also increasing detection quality."

The inspection of exterior features of packaging, as well as printed information on labels or packaging, plays a central role in this process. "These are the first elements that consumers see when looking for a particular product and are often a decisive factor in their purchasing decision," said Marques.

Faster processing speeds

Increasing cost pressures in production mean that faster processing speeds are being used. For many inspection systems this represents a major challenge when it comes to the precise detection of objects, including possible special cases in variable environmental conditions. The necessary computing power is often high and is associated with a reduction in processing speeds.

Over the past 40 years, each decade has produced a breakthrough in image-processing algorithms for object detection. In

the 1980s, binary image-based algorithms enabled relatively rapid object detection. This rapid algorithm was adapted to the very low computing power available, but demonstrated sensitivity to noise, lighting changes, shadowing, low contrasts and other conditions. By the 1990s, hardware speeds had increased rapidly, allowing a more accurate analysis of the image grayscale value whilst simultaneously reducing the number of problems encountered at low contrasts.

In the 2000s, edge-based algorithms brought about improvements with regard to lighting changes and shadowing, though these algorithms still had disadvantages when it came to blurring and low contrasts. The new sparse edge detection algorithm takes the information that is used and reduces it to clearly identifiable and representative points. This eliminates the possibility of errors occurring while also achieving significant improvements in speed.

In conventional inspection systems, minor deviations in the position of objects, e.g. due to a vibrating conveyor belt, can inhibit error-free or rapid processing of image information. Any countermeasures taken in the software to compensate for these errors may significantly reduce computing power, thereby reducing processing speeds. Often, a compromise must be reached between reliability and speed.

Variation-absorbing method

The new variation-absorbing method (patent pending) predicts possible variations in the representative points of the tracked objects. These variations are summarised using an intelligent clustering process. An analysis of these clusters reduces detection errors, while the processing speed remains high due to the low memory usage. This ensures that high-speed image processing can be completed with 10 times the level of precision (e.g. by comparing the root mean square error).

The criteria for achieving an object image that is as clear, stable and as simple as possible to process, are extremely complex. In the past, an improvement in this original image for processing by inspection systems was often judged by trial and error or by using expertise built up over many years.

The new visualisation and image optimisation concept of the Shape Search III software in the FH inspection system from Omron makes it easy to improve the image, even for inexperienced users. The software uses an intelligent approach that links the factors that influence the image and presents them to the user in such a way that intuitive optimisation can be achieved.