Fast Pattern Matching

Faster and more precise image processing methods and technology

SCOPE

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

In addition to final inspections, these producers are increasingly using in-line inspections at critical points in the corresponding processing steps. This article describes new image processing methods and the usage of optimized parallel hardware architecture to achieve a quantum leap in detection speed and accuracy.

CONTENT

WHITEPAPER

Executive Summary

Business Benefits

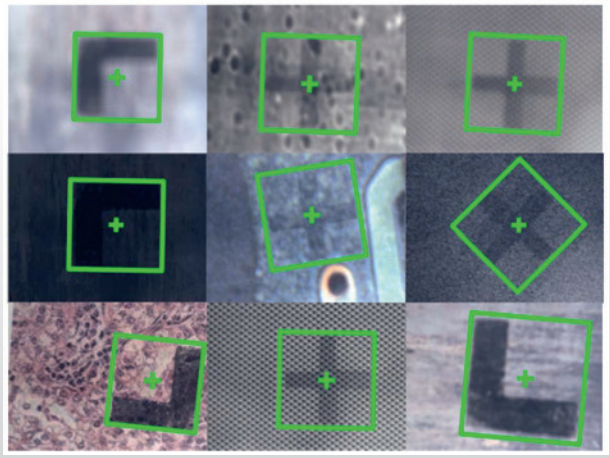
The key to a faster and more precise optical inspection is in the identification and tracking of the desired image objects. With new image processing algorithms (e.g., edge-based sparse features, variation absorbing templates etc.) and ultra-fast, parallel hardware architecture, the new FH optical inspection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

New image processing methods enable more than 10x faster detection during packaging inspection

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 this information has been applied correctly. In addition to final inspections, these producers are increasingly using in-line inspections at critical points in the corresponding processing steps.

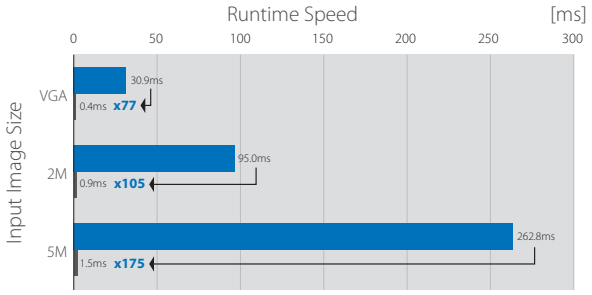
Image processing for high speed packaging processes often a compromise between speed and precision

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 and are often a decisive factor in their purchasing decision. They can even have legal consequences. However, 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 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.



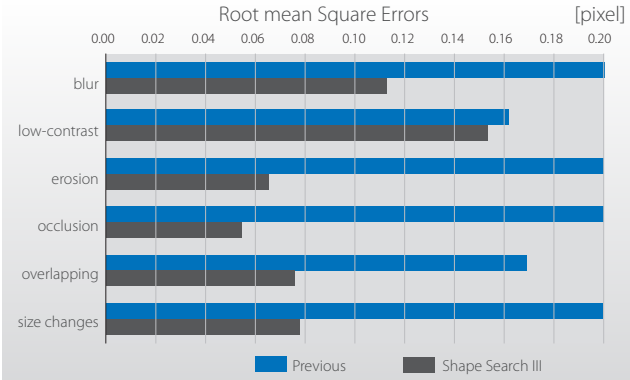
Accurate detection under challenging conditions can reduce processing speed

By using 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 10x faster than conventional inspection systems. Compared to previous algorithms, it can even achieve 100x faster speeds while also increasing detection quality.

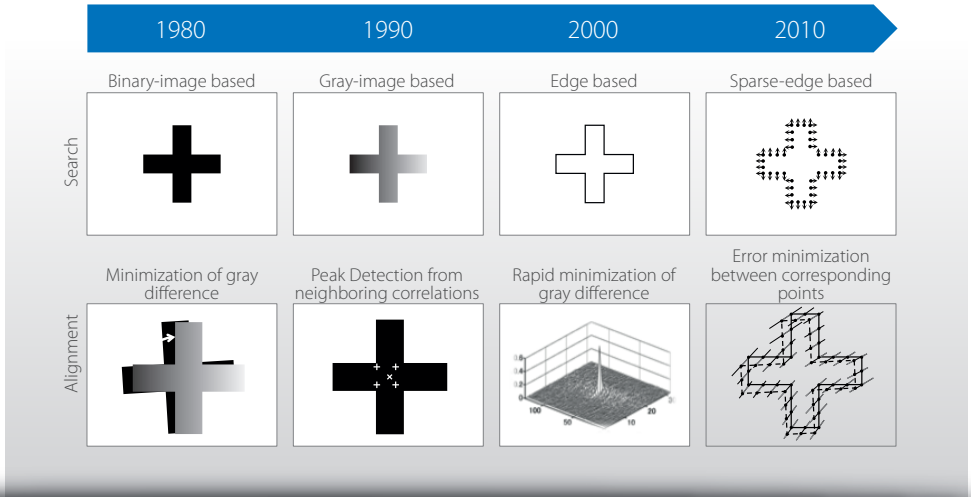


Detection speed improvement for different image sizes

Each decade since the 1980s has seen 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 were increasing rapidly, allowing for a more accurate analysis of the image gray scale value while 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.



Accuracy improvement (error reduction) on common optical inspection challenges



Key technology steps in optical pattern matching

Variation-absorbing method increases stability and speed through variation prognosis

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.

The new variation-absorbing method (patent pending) predicts possible variations in the representative points of the tracked objects. These variations are summarized 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 ten times the level of precision (e.g., by comparing the root mean square error).

Smart visualization method enables intuitive image optimization even for inexperienced users

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 visualization and image optimization 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 optimization can be achieved.

AUTHOR

Ruediger Klaeger
Team Leader Product Marketing
- Quality Control & Inspection

- Omron Europe B.V.
  Industrial Automation Business
  Division Sensing,
  Safety & Components
- Carl-Benz-Strasse 4. Nufringen,
  Germany
- Tel. +49 7032 811 154
- ruediger.klaeger@eu.omron.com

Educated as Electrical Engineer (Diplom-Ingenieur FH), Ruediger Klaeger started his professional career as development engineer for transformers.

He joined Omron in 1999 as a development engineer for inductive sensors bringing his extensive knowledge on electromagnetic fields to the company. In 2002 he joined the European Product Marketing team for industrial sensors as application support, product engineer and finally product manager. He has taken over the European Product Marketing for Quality Control & Inspection products, leading a team of product-, application- and software-engineers in 2010.

Omron Industrial Automation

With its headquarters in Kyoto, Japan, Omron Corporation is a global leader in the field of automation. Established in 1933 and currently headed by President Yoshihito Yamada, Omron now has more than 36,000 employees, in 210 locations around the world, working to provide products and services to customers in a variety of fields, including industrial automation, electronic components industries and healthcare. The company has head offices in Japan (Kyoto), Asia Pacific (Singapore), China (Hong Kong), Europe (Amsterdam) and US (Chicago).

OMRON Asia Pacific Regional HQ
T (65) 6835 3011
F (65) 6835 2711
E apac_enquiry@ap.omron.com
W omron-ap.com

Get Constant Updates

facebook.com/OmronAPAC.IAB

Australia
TF 1300 766 766
F (61-2) 9878 6981
E au_enquiry@ap.omron.com
W omron.com.au

India
T (91-22) 7128 8400
F (91-22) 7115 5602
E in_enquiry@ap.omron.com
W omron-ap.co.in

Indonesia
T (62-21) 2949 7500
F (62-21) 2949 7555
E id_enquiry@ap.omron.com
W omron.co.id

Malaysia
T (60-3) 7688 2888
F (60-3) 7688 2833
E my_enquiry@ap.omron.com
W omron-ap.com.my

New Zealand
T (64-9) 358 4400
F (64-9) 358 4411
E nz_enquiry@ap.omron.com
W omron-ap.co.nz

Philippines
T (63-2) 811 2831
F (63-2) 811 2583
E ph_enquiry@ap.omron.com
W omron-ap.com.ph

Singapore
T (65) 6547 6789
F (65) 6547 6769
E sg_enquiry@ap.omron.com
W omron-ap.com.sg

Thailand
T (66-2) 942 6700
F (66-2) 937 0501
E th_enquiry@ap.omron.com
W omron-ap.co.th

Vietnam
T (84-4) 3556 3444
F (84-4) 3556 3443
E hcm_enquiry@ap.omron.com
W omron.com.vn

Cat. No. AP019-E4-01-V01
(0517)