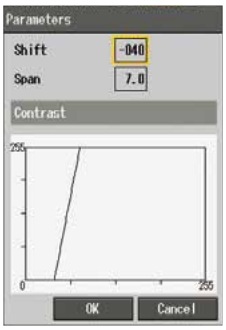
Image Processing

Image Filters: Part 2

This technical document introduces some of the advanced image filtering that is available. Image enhancement filters aid in achieving a stable image in order to create more contrast between the target and the background. They can also be used to remove image noise like halation.

1. Contrast Conversion Filter

Contrast conversion is a pre-filter for performing a more stable visual inspection by increasing contrast of a target with small difference in intensity.
This filter will enhance the intensity difference of a specific gradation region in the captured image.



Contrast conversion adjustment menu

Explanation

The offset and span (gain) can be adjusted to increase the rate of change for the intensity values within a specified range.

Raw image

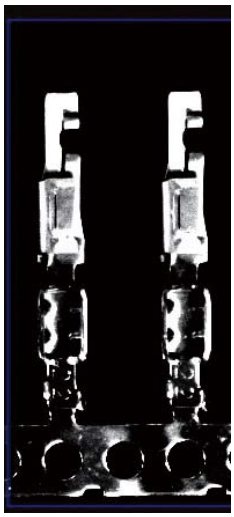
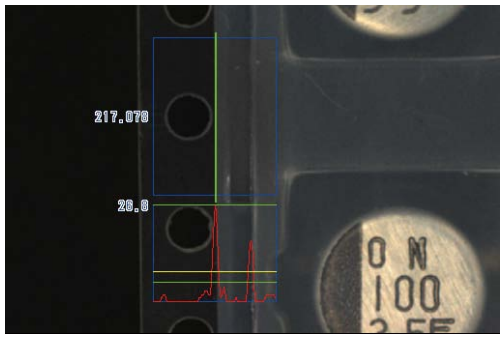


Image after converting contrast

\ Filtering Tips / Technique for using pre-filter



Raw image

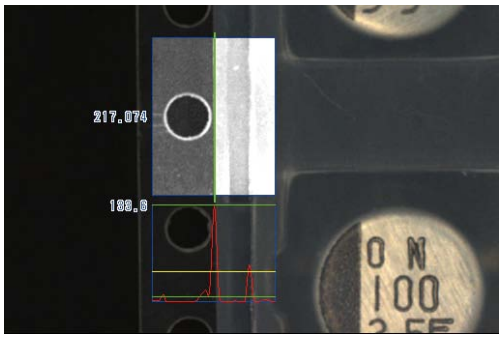
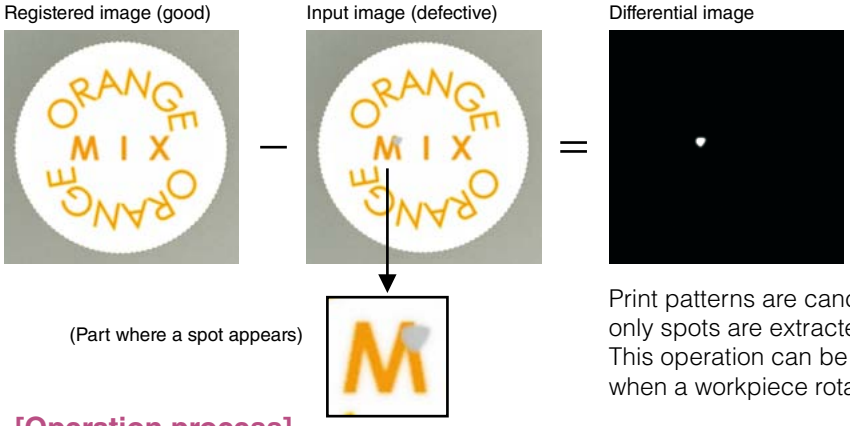


Image after applying contrast conversion filter

Detect the edge boundaries between transparent tape and the clear plastic reel.
To ensure more stable edge detection, increase the contrast difference of the boundary surface that is to be detected by using the contrast conversion filter.

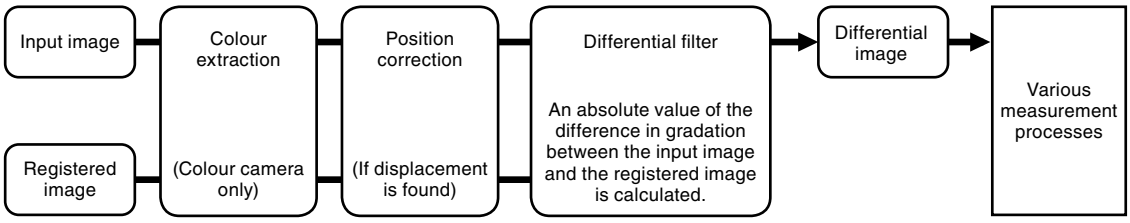
2. Image Subtraction Filter

The Subtract filter is an image enhancement filter that will calculate any intensity differences between the registered image and the captured image. This is useful to extract any areas that have changed from the original registered image like chips, dents, dirt or missing print. The vision tool will operate on the differential image.



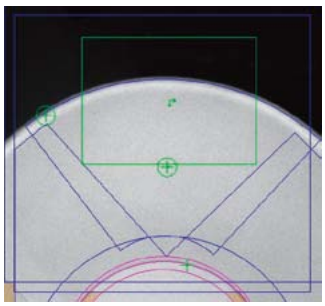
Print patterns are cancelled and only spots are extracted as defects. This operation can be applied even when a workpiece rotates.

[Operation process]

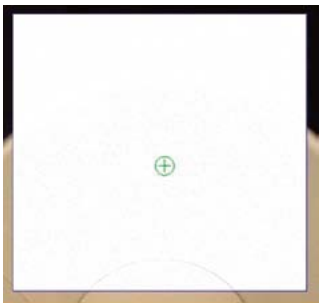


3. Real-Time Image Extraction Filter

The real time image extraction filter only extracts defects like small black spots or lines by taking the difference between the image created after applying the shrink/expand filters to the captured image and the captured image itself.
This filter can simplify the inspection of complex shapes without the need for aligning the inspection region to the outline of the part.

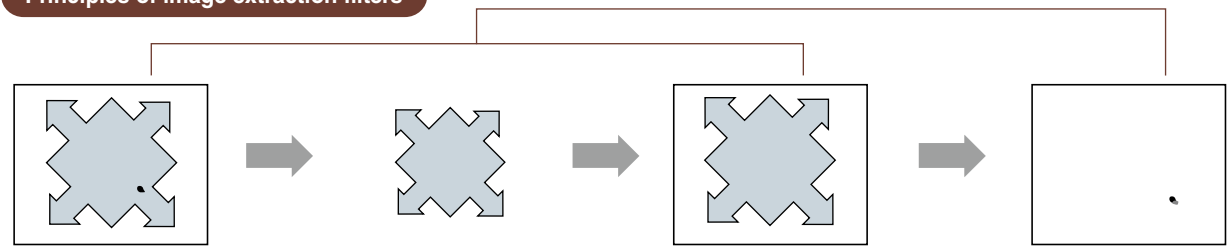


Inspection for defect on inside wall of a cup
Image of ordinary processing (complicated setting for aligning the area to the shape)



Real time differential image
(Inspection can be performed in the short form area only.)

Principles of image extraction filters



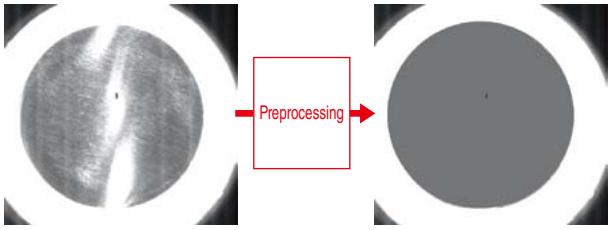
1. Captured image
2. Image with Expand filter (black spot removed)
3. Image with Shrink filter
4. Image result from subtracting the Raw Image (No.1) from the Expand/ Shrink Image (No.3).

Applying the Expand filter to the Raw image causes black spots or thin lines to disappear. In order to bring the target back to the original size, the Shrink filter is applied. The Raw image is then subtracted from this processed image and only the black spots or lines remain. This process is performed on each new captured image so the inspection remains stable even if the target shape changes.

4. Real-Time Shade Correction Filter

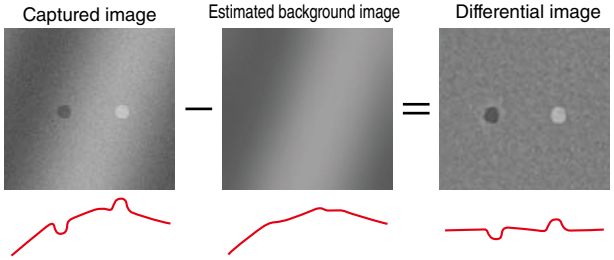
The real time shade correction filter is an image enhancement that is frequently used for visual inspection.
This filter is effective in reducing the effects of the background noise such as halation and patterns.

The image at the right shows an inspection for spots and foreign particles on the bottom of a beverage can. Halation occurs on the metal surface; however, it was removed by the Shade Correction filter and the image with only the spots can be processed.
Thus, this filter is very effective for eliminating uneven brightness such as halation.

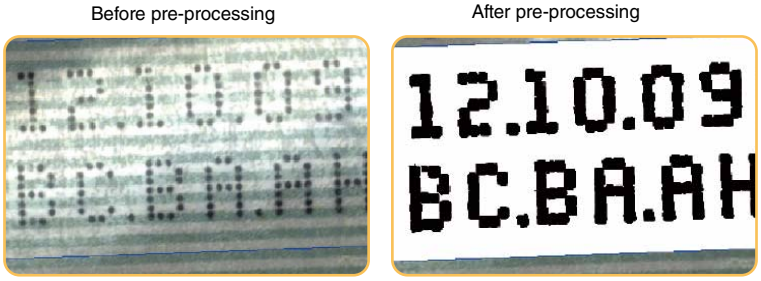


[Algorithm for the Shade Correction filter]

(1) Create an estimated background image from the raw captured image.
(2) Subtract the estimated background image from the captured image.
(3) Increase the gain and remove noise to ensure optimum image adjustment for the inspection.

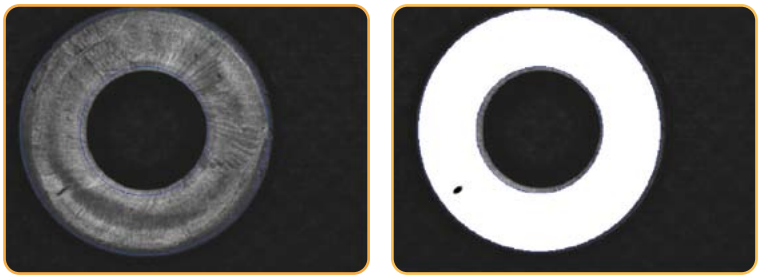


\ Filtering Tips / Technique for using image filters



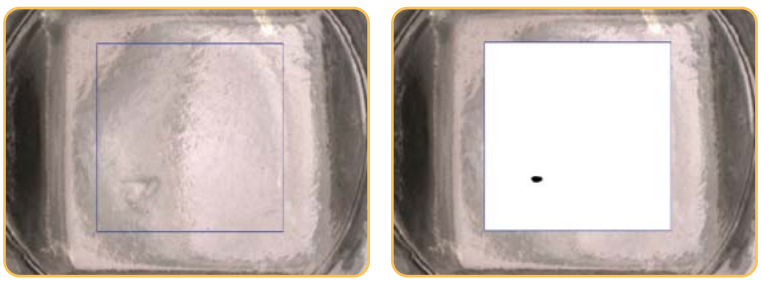
[Print inspection through film]

The impact of the background is improved by real time shade correction and stability is increased by shrinking and connecting dot prints to each other.



[Inspection for dents in metal parts]

Stable detection of dents can only be carried out by cancelling uneven background colour or uneven brightness of the metal workpiece itself using the real time shade correction filter.



[Detection of sink marks on a glass surface]

A sink mark which appears as a dark defect in diffused reflection is enhanced by the shrink filter and diffused reflection is cancelled by real time shade correction.

An introduction to lineup of image processing

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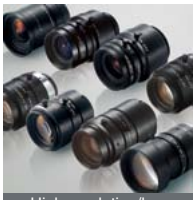
High resolution/low distortion lenses


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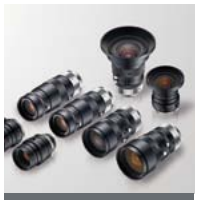
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