SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC513 – IMAGE PROCESSING AND COMPUTER VISION

III YEAR / V SEMESTER

Unit IV- MORPHOLOGICAL IMAGE PROCESSING

Topic : Opening and Closing for binary and gray image with application

Proper-Opening Function

The gray-level proper-opening function is a finite and dual combination of openings and closings. It removes bright pixels isolated in dark regions and smooths the boundaries of bright regions. The effects of the function are moderated by the configuration of the structuring element.

Proper-Closing Function

The proper-closing function is a finite and dual combination of closings and openings. It removes dark pixels isolated in bright regions and smooths the boundaries of dark regions. The effects of the function are moderated by the configuration of the structuring element.

Auto-Median Function

The auto-median function uses dual combinations of openings and closings. It generates simpler particles that have fewer details.

In-Depth Discussion

Erosion Concept and Mathematics

Each pixel in an image becomes equal to the minimum value of its neighbors.

For a given pixel P_0, the structuring element is centered on P_0. The pixels masked by a coefficient of the structuring element equal to 1 are then referred as P_i.

$P_0 = \min(P_i)$

Note A gray-level erosion using a structuring element $f \times f$ with all its coefficients set to 1 is equivalent to an Nth order filter with a filter size $f \times f$ and the value N equal to 0. Refer to the nonlinear filters section for more information.

Dilation Concept and Mathematics

Each pixel in an image becomes equal to the maximum value of its neighbors.

For a given pixel P_0, the structuring element is centered on P_0. The pixels masked by a coefficient of the structuring element equal to 1 are then referred as P_i.

$P_0 = \max(P_i)$

Note A gray-level dilation using a structuring element $f \times f$ with all its coefficients set to 1 is equivalent to an Nth order filter with a filter size $f \times f$ and the value N equal to $f^2 - 1$. Refer to the nonlinear filters section for more information.

Proper-Opening Concept and Mathematics

If *I* is the source image, the proper-opening function extracts the minimum value of each pixel between the source image *I* and its transformed image obtained after an opening, followed by a closing, and followed by another opening.

proper-opening(*I*) = min(*I*, *OCO*(*I*))

or

proper-opening(*I*) = min(*I*, *DEEDDE*(*I*))

where

I is the source image,
E is an erosion,
D is a dilation,
O is an opening,
C is a closing,
F(I) is the image obtained after applying the function *F* to the image *I*, and
GF(I) is the image obtained after applying the function *F* to the image *I* followed by the function *G* to the image *I*.

Proper-Closing Concept and Mathematics

If *I* is the source image, the proper-closing function extracts the maximum value of each pixel between the source image *I* and its transformed image obtained after a closing, followed by an opening, and followed by another closing.

proper-closing(*I*) = max(*I*, *OCO*(*I*))

or

proper-closing(*I*) = max(*I*, *EDDEED*(*I*))

where

I is the source image,
E is an erosion,
D is a dilation,
O is an opening,
C is a closing,
F(I) is the image obtained after applying the function *F* to the image *I*, and
GF(I) is the image obtained after applying the function *F* to the image *I* followed by the function *G* to the image *I*.

Auto-Median Concept and Mathematics

If *I* is the source image, the auto-median function extracts the minimum value of each pixel between the two images obtained by applying a proper-opening and a proper-closing of the source image *I*.

auto-median(*I*) = min(*OCO*(*I*), *COC*(*I*))

or

auto-median(*I*) = min(*DEEDDE*(*I*), *EDDEED*(*I*))

where

I is the source image,
E is an erosion,
D is a dilation,
O is an opening,
C is a closing,
F(I) is the image obtained after applying the function *F* to the image *I*, and
GF(I) is the image obtained after applying the function *F* to the image *I* followed by the function *G* to the image *I*.


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