Lecture 5 Group Operators

COMP3204 & COMP6223 Computer Vision

How do we combine points to make a new point in a new image?

Book
pp
98 - 112

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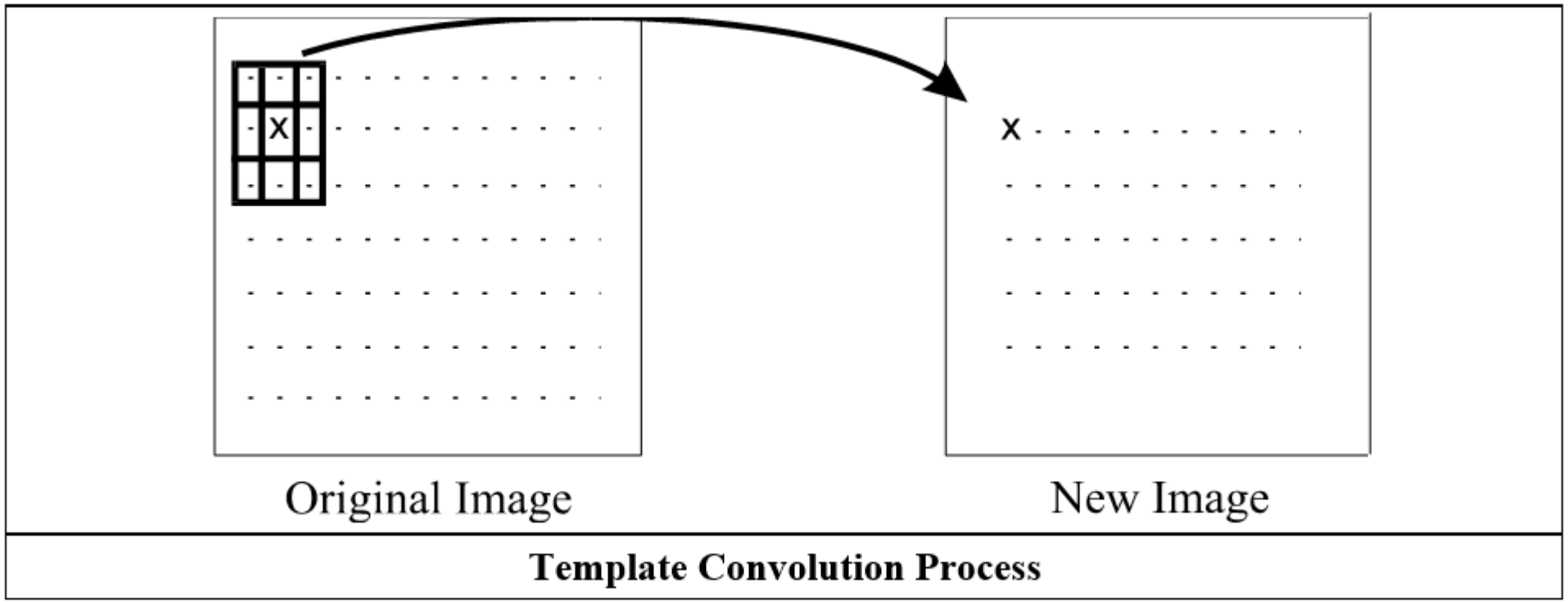


Template Convolution Process

Template Convolution

Image

100	100	200	200	200
100	100	200	200	200
100	100	200	200	200
200	200	400	400	400
300	300	400	400	400

0	0	0	0	0
0	400	400	0	0
0	400	400	0	0
0	400	400	0	0
0	0	0	0	0

G_y

Result

0	0	0	0	0
0	400	400	0	0
0	640	806	800	0
0	894	894	800	0
0	0	0	0	0

-1	-2	-1		
0	0	0		
1	2	1		

0	0	0	0	0
0	0	0	0	0
0	500	700	800	0
0	800	800	800	0
0	0	0	0	0

G_x

Template Convolution

Image

100	100	200	200	200
100	100	200	200	200
100	100	200	200	200
200	200	400	400	400
300	300	400	400	400

0	0	0	0	0
0	400	400	0	0
0	400	400	0	0
0	400	400	0	0
0	0	0	0	0

Result

Template

-1	0	1
-2	0	2
-1	0	1

w_0	w_1	w_2
w_3	w_4	w_5
w_6	w_7	w_8

3×3 Template and Weighting Coefficients

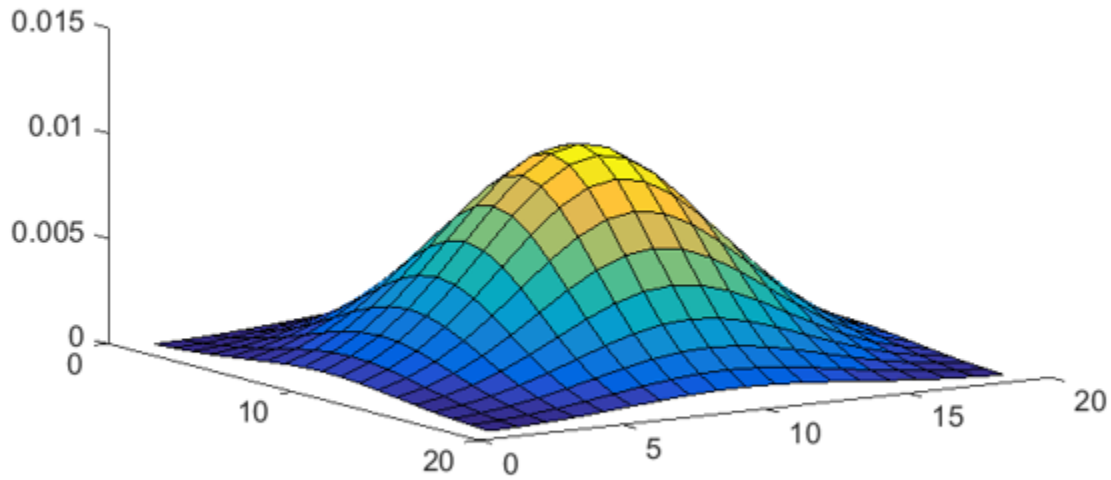
$$\mathbf{N}_{x,y} = \begin{array}{l} w_0 \times \mathbf{O}_{x-1,y-1} + w_1 \times \mathbf{O}_{x,y-1} + w_2 \times \mathbf{O}_{x+1,y-1} + \\ w_3 \times \mathbf{O}_{x-1,y} + w_4 \times \mathbf{O}_{x,y} + w_5 \times \mathbf{O}_{x+1,y} + \\ w_6 \times \mathbf{O}_{x-1,y+1} + w_7 \times \mathbf{O}_{x,y+1} + w_8 \times \mathbf{O}_{x+1,y+1} \end{array} \qquad \forall x, y \in 2, N-1$$

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

3×3 Averaging Operator Template Coefficients

Applying Direct Averaging

		
(a) 5×5	**(b)** 7×7	**(c)** 9×9
Illustrating the Effect of Window Size		



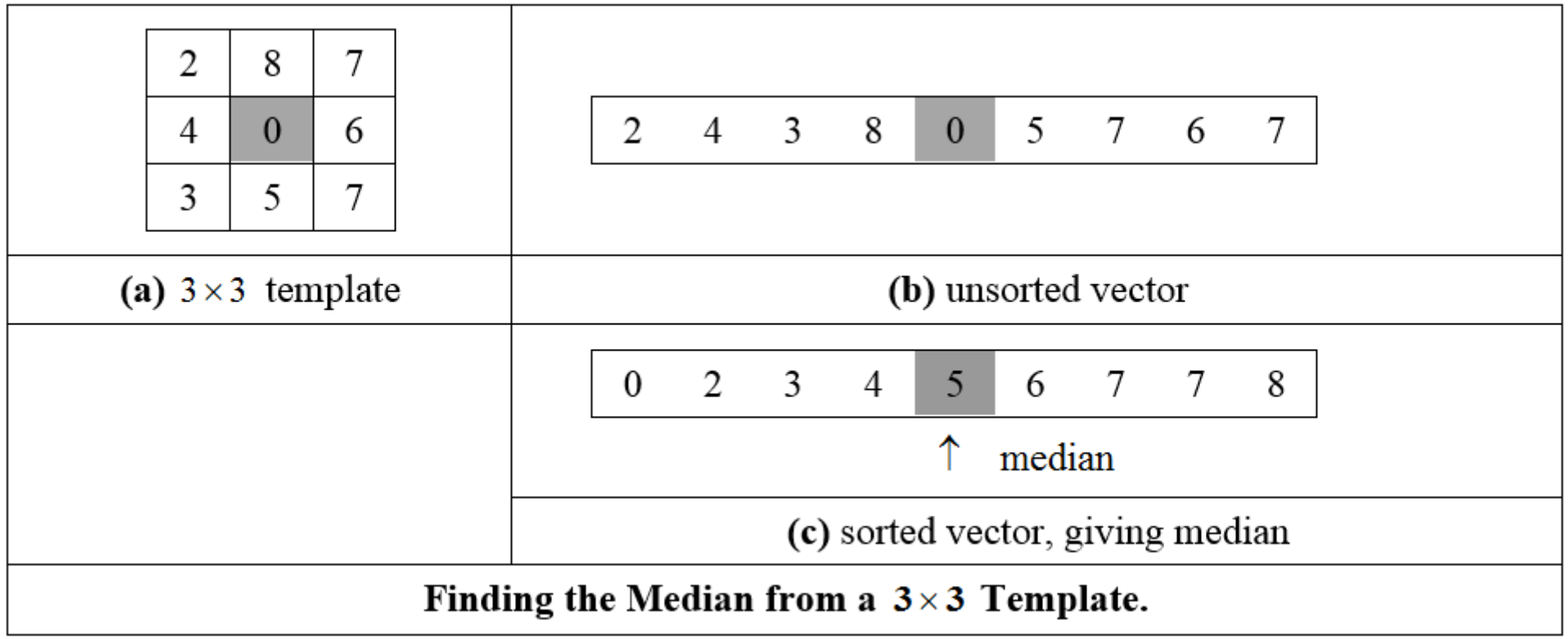
Gaussian Function

(a) 3×3

(b) 5×5

(c) 7×7

Applying Gaussian Averaging

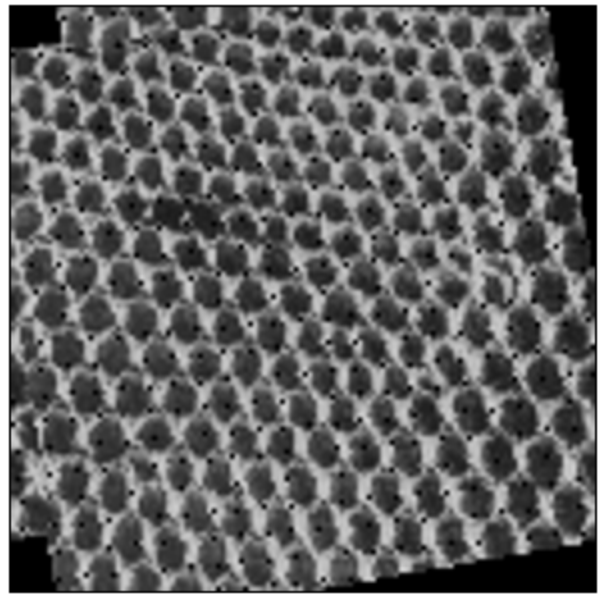


(a) 3×3 template

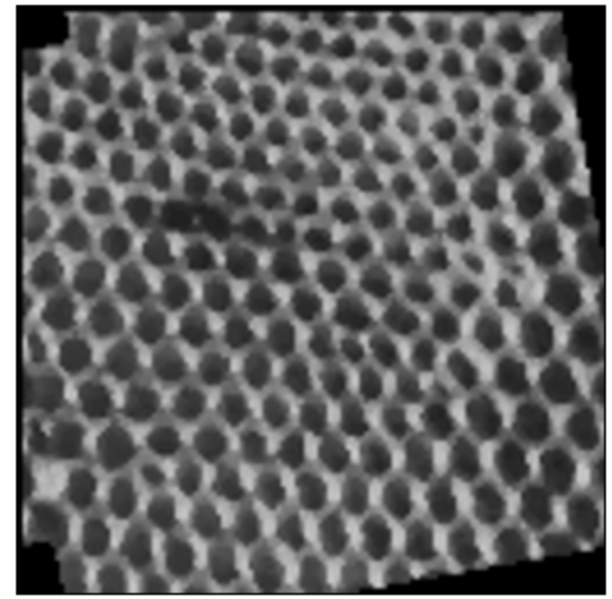
(b) unsorted vector

(c) sorted vector, giving median

Finding the Median from a 3×3 Template.



(a) rotated fence



(b) median filtered

Illustrating Median Filtering

(a) Original

(b) (a) with added Gaussian noise

(c) Averaged

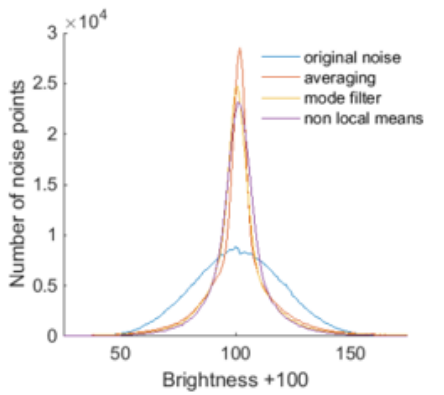
(d) Gaussian smoothed

(e) Median

(f) Truncated Median

(g) Anisotropic diffusion

(h) Non-local-means



(i) Effect of filtering on noise

Comparison of Filtering Operators